Rolling Knolls Landfill Settling Parties

Data Gaps Sampling and Analysis Plan

Rolling Knolls Landfill Superfund Site

Chatham, New Jersey

October 2014

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Acronyms and Abbreviations

Agreement	Administrative Settlement Agreement and Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirement
ARCADIS	ARCADIS U.S., Inc.
BBL	Blasland, Bouck & Lee, Inc.
bgs	below ground surface
BERA	Baseline Ecological Risk Assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	Contract Laboratory Program
CTBH	Chatham Township Board of Health
Data Gaps SAP	Data Gaps Sampling and Analysis Plan
DLUR	Division of Land Use Regulation
EBSL	ecologically based screening level
FHA	flood hazard area
FIT	Field Investigation Team
Foster Wheeler	Foster Wheeler Environmental Corporation
FS	feasibility study
FWW GP-12	Freshwater Wetlands General Permit 12
GPS	global positioning satellite
GSNWR	Great Swamp National Wildlife Refuge
GWQC	Groundwater Quality Criteria
LDPE	low density polyethylene
MCL	Maximum Contaminant Limit

mL/min	milliliters per minute
N.J.A.C.	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
OCP	organochlorine pesticide
PAH	polycyclic aromatic hydrocarbon
PPNDP	passively placed narrow diameter points
PCB	polychlorinated biphenyl
PCSM	Preliminary Conceptual Site Model
PID	photoionization detector
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RI	remedial investigation
SAT	Site Assessment Team
SCSR	Site Characterization Summary Report
SEBS	styrene/ethylene/butylenes/silicone
SIM	selective ion monitoring
site	Rolling Knolls Landfill Superfund Site, located in Chatham Township, New Jersey
SRS	Soil Remediation Standard
SVOC	semivolatile organic compound
TAL	Target Analyte List
TCL	Target Compound List
TestAmerica	TestAmerica Laboratories, Inc.

the Group	Chevron Environmental Management Company, Lucent Technologies Inc., (now known as Alcatel-Lucent USA Inc.) and Novartis Pharmaceuticals Corporation
TOC	total organic carbon
USEPA	United States Environmental Protection Agency
USFWS	United States Fish & Wildlife Service
USGS	United States Geological Survey
VOC	volatile organic compound
Weston	Weston Solutions, Inc.
μg/L	micrograms per liter

1. Introduction

On behalf of Chevron Environmental Management Company, Lucent Technologies Inc., (now known as Alcatel-Lucent USA Inc.) and Novartis Pharmaceuticals Corporation (collectively, the Group), ARCADIS U.S., Inc. (ARCADIS) prepared this Data Gaps Sampling and Analysis Plan (Data Gaps SAP) for the Rolling Knolls Landfill Superfund Site, located in Chatham Township, New Jersey (the site, Figure 1).

On September 30, 2005, the Group entered into an Administrative Settlement Agreement and Order on Consent (Agreement) with the United States Environmental Protection Agency (USEPA) to conduct a remedial investigation/feasibility study (RI/FS) at the site (Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA] Docket No. 02-2005-2034). Since that time, the Group has conducted several investigations and assessments to evaluate environmental conditions at the site. The investigations culminated in a Site Characterization Summary Report (SCSR) which was submitted to the USEPA in February 2012 (ARCADIS 2012). In its letter of March 7, 2013, the USEPA identified several data gaps related to delineation of constituents in environmental media (USEPA 2013). To address these data gaps, ARCADIS prepared a Preliminary Plan to Address Data Gaps (April 30, 2013; ARCADIS 2013). The work proposed in this Preliminary Plan was to be conducted during the design of the site remedy.

However, during subsequent scoping of the Baseline Ecological Risk Assessment (BERA), USEPA offered the Group the option of assessing the data gaps before implementing the BERA so that the additional data could be used in scoping the BERA (USEPA letter of July 30, 2014; USEPA 2014). The Group has accepted this option and has prepared this Data Gaps SAP to define the scope of the data gaps sampling and the sampling and analytical procedures. The scope of the sampling is consistent with the Preliminary Plan and with comments provided by USEPA to the Group in an email on August 12, 2014. The scope of the sampling was also discussed by the Group, ARCADIS, and the USEPA in a meeting on August 19, 2014.

1.1 Objectives

The objectives of the data gaps sampling are as follows.

- Assess the Data Gaps identified in EPA's August 12, 2014 email attachment

- Further delineate the extent of site constituents at concentrations above the New Jersey Soil Remediation Standards (SRSs) in soil in portions of the site.
- Delineate the extent of site constituents in groundwater at monitoring wells MW-3 and MW-10 by sampling groundwater, surface water, and sediment.
- Characterize surface water and sediment in ponds on the landfill that were not previously sampled.
- Investigate the potential presence of site constituents in sediment pore-water downgradient of monitoring well MW-10.
- Obtain a full round of groundwater samples from all monitoring wells to characterize current constituent concentrations in groundwater.
- Investigate the connection between groundwater and surface water on site.
- Assess conditions at the existing Hunt Club well HC-1.

The provisions of Section 4.2 of the NJDEP’s Technical Requirement for Site Remediation will be met during implementation of the SAP. Data that may be considered for delineation of the nature and extent of the site include the depth of the landfilled materials, groundwater quality data, presence of a thick clay layer beneath the site, and other factors.

1.2 Data Gaps SAP Organization

This Data Gaps SAP is organized as described below.

- Section 2, Site Background and Setting, presents the site location; discusses usage of the site and properties adjacent to the site; describes the physical setting of the site; summarizes the site history, including the investigative and regulatory history, and summarizes the investigation results previously submitted to the USEPA in the SCSR.
- Section 3, Data Gaps SAP Tasks, presents each task that will be conducted as part of the Data Gaps SAP and outlines proposed technical activities that will be conducted to complete each task.
- Section 4, Schedule, presents a schedule for the Data Gaps SAP activities.
- Section 5, Project Management, introduces the project team and describes the responsibilities of each project team member.

- Section 6, References, provides references used in the development of this Data Gaps SAP.

A Quality Assurance Project Plan (QAPP), submitted separately, provides supporting information on site conditions, sampling requirements and procedures, and laboratory analytical procedures.

2. Site Background and Setting

2.1 Site Description

The Rolling Knolls Landfill site is an approximately 200-acre, unlined, former municipal landfill located at 35 Britten Road in the Green Village section of Chatham Township, Morris County, New Jersey. The facility is bound by the Great Swamp National Wildlife Refuge to the east, south, and west; Loantaka Brook and private property to the west; and private residential properties to the north and northwest. The Rolling Knolls Landfill overlaps the Refuge on its eastern and southern sides (Figure 1). As discussed in Sections 2.2.1 and 3.1 of the SCSR, observations made during test pit excavation (which, for that investigation, included hand auger borings in areas where proposed test pit locations were not accessible to excavation equipment) show that the waste material that constitutes the landfill includes 141 acres where waste has been filled, and 29 acres where a thin layer of waste and debris has been observed on but not below the ground surface (i.e., the surface debris area) along the western portion of the site. Figure 2 presents a Site Plan, which depicts the estimated landfill boundary, as understood prior to RI activities, as well as the estimated boundaries of the landfill and surface debris area, based on visual observations and test pit activities.

As shown on Figure 2, the central and western portions of the site are owned by Robert J. Miele as Trustee for the Trust created by the Last Will and Testament of Angelo J. Miele, the former landfill operator. Eastern and southern portions of the site are located within the Great Swamp National Wildlife Refuge (GSNWR) and owned by the United States Fish & Wildlife Service (USFWS). A northeastern portion of the site occurs on a parcel owned by the Green Village Fire Department, which also includes a baseball field and shooting range. Although the baseball field and shooting range are located within the estimated landfill boundary that was approximated prior to RI activities, test pit activities indicated that no landfilling occurred in these areas (Figure 2).

Water likely flows vertically through the waste materials with some small horizontal component, and upon reaching the saturated material below, flows laterally with the natural groundwater flow patterns. Groundwater flow is expected to occur laterally through the sand and/or silty sand units. The groundwater flow in the shallow water-bearing zone above the clay is expected to be horizontal until reaching areas of discharge. Groundwater flows radially from the northern portion of the landfill to the south, east and west areas of lower topographic elevation as presented in Section 3.4.4.2 of the SCSR.

Physical access to the majority of the site is limited by a chained gate on Britten Road; wet areas and brooks along the eastern, western and southern boundaries; and the exclusion of visitors to the Wilderness Area section of the GSNWR located on a portion of the site and to the east and south. Black Brook is located east and south of the estimate landfill boundary and generally flows southward and westward in these respective areas. Loantaka Brook is located west of the estimated landfill boundary and flows southward. Residential properties are located north of the site and west of Loantaka Brook. The surrounding area is sparsely populated, consisting of individual residential properties on large parcels and undeveloped open spaces.

Current land use includes commercial/industrial and recreational uses; available data indicate that residents do not live within 200 feet of the estimate landfill boundary. Portions of the site are used for equipment storage by two landscaping companies. Therefore, workers are present at times to deliver, retrieve or maintain landscaping equipment and supplies. In addition, recreators may occasionally hunt on other portions of the site or use the softball field and shooting range.

2.2 Site History

The Rolling Knolls Landfill reportedly operated from the 1930s until 1968. During this period, materials disposed of at the landfill consisted primarily of municipal solid waste, but may have also included other waste such as industrial wastes (Foster Wheeler Environmental Corporation [Foster Wheeler] 2000). Chatham Township Board of Health (CTBH) inspection records indicate that municipal solid waste brought to the landfill included tree stumps, scrap metal, tires, normal household refuse, residential septage wastes, and construction and demolition debris from home construction or renovation. Reported sources of this waste include the surrounding municipalities of Summit, South Orange, Maplewood, Chatham Township, Chatham Borough, Millburn, Madison, Harding Township and Florham Park. Private haulers and homeowners also brought household waste to the landfill. Aerial photographs indicate that by 1966 the landfill had doubled in size from the observed size in 1940 (USEPA 2004). The landfill has been inactive since 1968.

CTBH regulation between 1955 and 1975 required rodent/mosquito control, stagnant surface water drainage, weekly inspections and application of minimal daily cover (Foster Wheeler 2000). The latter involved applying a layer of “swamp muck,” taken from the edge of the landfill, over the daily rubbish fill. Additional landfill procedures documented by the CTBH in 1962 included weed control (herbicides), dead animal disposal, dust control measures (oil application on landfill roadways) and chemical spraying for rodent control (Foster Wheeler 2000). Prior to the construction of municipal sewer systems and sewage treatment plants, septage waste was allowed to flow over the working surface and percolate into the landfill. In the early- and mid-1960s, septage haulers were required to register with the Chatham Township police department to prevent out-of-town haulers from using the landfill for disposal (Foster Wheeler 2000).

As stated in a USEPA January 26, 2006 comment letter regarding the Preliminary Conceptual Site Model (PCSM) (Blasland, Bouck & Lee, Inc. [BBL] 2006), the USFWS purchased 310 acres of land eligible to be used for landfilling activities in 1964. These acres became part of the GSNWR. Approximately 40 of the 310 acres purchased by the USFWS were already filled with landfill material when purchased in 1964 (Foster Wheeler 2000), as evidenced in the 1963 aerial photograph. Evidence suggests that landfilling continued on the GSNWR property after the purchase. The refuge was initially created by land donation, acquisition and other means in the 1960s and has grown in size since then (Foster Wheeler 2000).

In 1974, an area between 200 and 400 feet wide and approximately 1,200 feet long was affected by a fire. Fire trucks and other support vehicles were unable to access the fire line and the fire was finally extinguished with the use of bulldozers. The physical composition of the landfill material limited access to the fire zone as vehicles driven off the regular access roads sank into the landfill. After this fire, between 1979 and 1982, fire roads were constructed of imported material, including construction and demolition debris, at an elevation approximately 4 feet above the surrounding landfill surface (Foster Wheeler 2000).

2.3 Investigative History

This section chronicles environmental investigations at the site. Results of the investigations were incorporated into the PCSM (BBL 2006) and summarized in the RI/FS Work Plan (ARCADIS BBL 2007).

In 1985, a site inspection was initiated by the USEPA Region 2 Field Investigation Team (FIT) in response to the possible presence of uncharacterized process waste. Four surface water, one surface soil and four sediment samples (0 to 6 inches deep) were collected at various locations on the landfill surface (in areas not associated with Loantaka Brook) or in the wet areas of the GSNWR, away from the landfilled material.

The samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), organochlorine pesticides (OCPs) and metals (Foster Wheeler 2000).

In 1986, the FIT conducted a drilling and soil sampling program to evaluate the depth of the fill, nature of possible soil impacts and presence of dioxin in landfill soil. The samples were collected at different depths from eight boreholes and were analyzed for VOCs, SVOCs, PCBs, OCPs, metals and dioxin (NUS Corporation 1986).

In 1988, the USFWS conducted a survey of fish tissue and sediments (USFWS 1991). Sampling locations were biased to evaluate the condition of streams associated with roadways and other potential source areas. The investigation quantified concentrations of metals and polycyclic aromatic hydrocarbons (PAHs; a subset of SVOCs) present in fish tissue and concentrations of metals, OCPs and PAHs present in sediment.

In 1989, a joint agreement between the USFWS and the United States Geological Survey (USGS) led to the collection of 18 surface water and three groundwater samples on the perimeter of the landfill and in Loantaka Brook. The surface water and groundwater samples were analyzed for major inorganic ions, dissolved trace elements, VOCs and SVOCs. Sediment from Loantaka Brook was analyzed primarily for inorganic constituents (USGS 1993).

In 1999, Foster Wheeler (on behalf of USEPA) conducted a field investigation to document current conditions. The investigation included seven exploratory soil borings, two monitoring well installations and environmental sample collection (i.e., 21 surface water, 10 groundwater, 21 sediment and 15 soil samples). Samples were analyzed for metals, OCPs, PCBs, SVOCs and VOCs (Foster Wheeler 2000). In April 2000, supplemental data were collected at sampling locations identified with a global positioning system (GPS) (Foster Wheeler 2000).

From March 31 to April 10, 2003, the USEPA Region 2 Site Assessment Team (SAT) conducted field investigations at the site. The initial phase of investigation included collection and PCB field screening of soil and sediment samples. The second phase of the investigation included collection of confirmatory soil and sediment samples analyzed in a laboratory. In the second phase, additional sediment samples were collected from locations where sampling personnel observed drums or other visual indications of possible source material. The samples were classified as soil if they were collected from non-wetland (i.e., upland) areas or sediment if they were collected from wetland areas. Samples were analyzed for Target Compound List (TCL) and Target

Analyte List (TAL) (excluding cyanide) constituents. Additional sample volume was collected at sediment sampling locations and analyzed for total organic carbon (TOC) and particle size (Weston Solutions Inc. [Weston] 2003a, 2003b, 2003c).

In 1999, the USFWS conducted a 10-year follow-up investigation to its 1988 investigation. The purpose of this investigation was threefold: 1) quantify concentrations of metals, OCPs and PAHs in GSNWR sediment and metals and OCP concentrations in fish tissue; 2) compare the data to the 1988 data; and 3) identify the change in concentrations, if any, in sediment and fish tissue samples (USFWS 2005). The USFWS did not collect samples outside its boundaries during its 1999 investigation because it was not granted access by property owners. Additionally, samples were not collected on the 40 acres of landfill owned by the USFWS.

After the Agreement was signed, the Settling Parties conducted an extensive site investigation sampling between June 2006 and January 2010. Results from this investigation are presented in the SCSR and summarized in Section 2.5.

2.4 Regulatory History

A Hazard Ranking System Documentation Package was issued by the SAT in April 2003. The site was proposed to the National Priorities List on April 30, 2003 and listed on September 29, 2003.

The Agreement was signed by the USEPA and the Group on September 30, 2005 (USEPA Index Number II-CERCLA-02-2005-2034). The Site USEPA ID number is NJD980505192.

2.5 Summary of the Results in the SCSR

The SCSR describes the results of RI activities conducted at the site. RI activities were comprehensive and intended to characterize the landfill and nature and extent of constituents associated with the landfill. The results of the investigations includes:

- The estimated landfill boundary covers 141 acres and consists of a relatively thin (18 feet or less) layer of waste material directly overlying native soil and/or wetlands. An area of surface debris was identified on 29 acres west of the landfill. The total area where waste is present is approximately 170 acres.

- Surface and subsurface soil impacts were identified across the site. Few, isolated impacts were observed within the surface debris area in western portion of the site and along the western and southwestern perimeter of the site. The baseball field and shooting range are located north of the landfill and analytical results do not identify landfill debris in soil in those areas.

- Two areas of impacted groundwater were observed in the shallow water-bearing zone (at monitoring wells MW-3 and MW-10). VOCs identified in groundwater at these two monitoring wells are likely associated with potential sources observed nearby: VOC-impacted soil and drums at test pit TP-09 near MW-3 and the refrigerators on the ground surface near MW-10. The supply well adjacent to the Hunt Club building was sampled and may provide a snapshot of water quality from the deep aquifer beneath the landfill. Impacts of organic constituents were not identified.

- Sub-slab soil gas from beneath the Hunt Club building, which is not currently used for residential occupancy was investigated. The small number of volatile compounds detected in soil gas and their low concentrations do not indicate extensive impacts to soil gas beneath the Hunt Club building.

- Surface water and sediment in the ponds and streams (Loantaka Brook and Black Brook) on or adjacent to the landfill exhibit some constituents that are found at the site. Many of these constituents are also found in surface water and sediment upstream of the site. Therefore, their presence in the streams may be in part due to sources upgradient of the site.

3. Data Gaps SAP Tasks

3.1 Pre-Characterization and Site Preparation Activities

The activities discussed in the following subsections will be conducted to prepare the study area prior to investigation activities.

3.1.1 Vegetation Clearing

The existing fire roads will be mowed to permit vehicle traffic. Sampling activities may require minor vegetation clearing (e.g., clearing a path not to exceed 3 feet in width by trimming vegetation with hand tools) along survey lines and/or to provide access to individual soil sampling locations. The amount of vegetation cleared during soil sampling activities will be the minimum necessary to safely mobilize equipment and personnel on foot to the proposed sampling location and provide a safe work area. During installation of temporary and permanent monitoring wells, vegetation may also be cleared with the aid of a track-mounted skid steer. ARCADIS will prepare the appropriate Land Use Regulation permit equivalencies, as discussed in Section 3.1.3, for vegetation clearing conducted with the aid of an excavator or other motorized vehicle.

Some activities will occur in potential bog turtle habitat, as identified on Figures 3a and 3b. In a June 30, 2009 comment letter on the Draft RI/FS Work Plan Addendum, USEPA provided USFWS recommendations for working in areas of potential bog turtle habitat in a manner that is protective of bog turtles. When working in these areas, field personnel will implement the following USFWS-recommended conservation measures:

- Carry a copy of the USFWS bog turtle fact sheet to aid in identification of bog turtles and their habitats.
- Be mindful of foot and equipment placement.
- Avoid walking on hummocks, as bog turtle use hummocks for nesting, resting and sunning.
- Use the minimum number of personnel for each activity.
- Enter and leave work area in a single file line in order to minimize the possibility of accidental trampling.

- In the event they are observed in the work area, avoid touching or disturbing suspected bog turtle(s) and quietly leave the work area.

- Report suspected or confirmed bog turtle sightings to GSNWR personnel as soon as practical.

3.1.2 Underground Utility Clearing

In accordance with New Jersey state law and site-specific health and safety procedures (described in the site Health and Safety Plan), subsurface utilities will be identified, located and marked out prior to initiating intrusive subsurface field activities, such as soil boring advancement or drilling. ARCADIS personnel will contact the New Jersey One-Call service center to coordinate utility mark outs with participating utility operators that have utilities in areas where intrusive subsurface activities are planned. In areas where another contractor will conduct intrusive subsurface field activities (e.g., driller), that contractor will be responsible for contacting the New Jersey One-Call service center to coordinate utility mark outs. ARCADIS will document results for both New Jersey One-Call utility mark outs.

Based on information obtained during previous RI activities, ARCADIS identified proposed sampling locations for which additional evidence is needed to minimize any reasonable concern regarding the location of subsurface utilities within the work area. Following the completion of utility mark outs by participating utility operators, these locations will either be cleared by hand or by a private utility locating service. At proposed sampling locations that will be sampled using a hand-driven Macrocore®, ARCADIS personnel will clear a proposed sampling location by advancing a hand auger or shovel to 1 foot below ground surface (bgs) at multiple locations around the proposed sampling location such that any reasonable concern regarding the location of subsurface utilities within the work area is minimized. Hand clearing will be conducted immediately prior to Macrocore® advancement. ARCADIS will reposition sampling locations as appropriate to avoid subsurface utilities while maintaining the integrity of the proposed sampling design.

3.1.3 Freshwater Wetland Permits/Permit Equivalencies

The New Jersey Department of Environmental Protection (NJDEP) Division of Land Use Regulation (DLUR) regulates certain activities under New Jersey Administrative Code (N.J.A.C.) 7:7A when conducted in freshwater wetlands or transition areas and under N.J.A.C. 7:13 when conducted in a flood hazard area (FHA) or riparian zone of a regulated water. Activities proposed herein may include implementation of regulated activities, such as vegetation clearing, advancing borings deeper than 3 feet bgs and use of heavy machinery (e.g., skid steer) in freshwater wetlands, transition areas or FHA. Implementation of regulated activities typically requires acquisition of approved DLUR permits from NJDEP prior to the start of work. However, the proposed activities are a component of a USEPA-led RI conducted under CERCLA. As such, the proposed activities qualify for submittal of NJDEP DLUR permit equivalency packages. To this end, ARCADIS will prepare and submit the following land use permit equivalency packages to NJDEP in accordance with N.J.A.C. 7:7A and N.J.A.C. 7:13, respectively. These documents will include a compliance statement for the respective regulation and provide information regarding on-site wetlands, management practices and appropriate restoration measures.

Freshwater Wetlands General Permit 14 (FWW GP-14) – Water Monitoring Devices

A blanket FWW GP-14 authorizes the installation of groundwater monitoring wells or other water monitoring devices at locations in freshwater wetlands, transition areas and State open waters, including:

- drilling and installing permanent or temporary monitoring wells by machine
- cutting vegetation no wider than 5 feet by machine for a survey line
- cutting vegetation greater than 3 feet wide by hand for a survey line

FHA Permit-by-Rule 7:13-7.2(a)2 – Constructing in Disturbed Riparian Zones or at/or Below Grade in an FHA

An FHA Permit-by-Rule 7:13-7.2(a)2 authorizes activities in disturbed riparian zones or FHA, provided:

- the activity is conducted at or below grade in an FHA and existing surface elevations are not raised
- the activity is not located within 25 feet of any top of bank or water’s edge
- the activity is not a major development, as defined at N.J.A.C. 7:8-1.2

- no vegetation is cleared, cut or removed from a riparian zone except where previous disturbance has occurred

- vegetation temporarily disturbed in the riparian zone is replanted with indigenous, non-invasive species

The need for additional land use permits, if any, will be identified during other pre-characterization activities.

3.2 Soil Sampling

3.2.1 Soil Sample Locations

The soil sampling locations are shown on Figures 3a and 3b, along with previous surface soil sample results that were used to select the proposed locations. Proposed locations are also summarized in Table 1. All locations are in potentially wet areas and will consist of wetland soil.

The soil sampling locations proposed (sample numbers SS-125 through SS-158) are in native soil near previous soil samples along the estimated landfill boundary where the concentrations of one or more constituents exceeded its SRS. In addition, USEPA recommended six additional soil samples to obtain data that can be used in developing the BERA Work Plan. One of these samples (sample number SS-159) is near the two ponds at the northern extent of the landfill, and the remaining five samples (sample numbers SS-160 through SS-164) are located in the southern and western portion of the site.

Sampling at locations SS-125 through SS-158 will be conducted in a step-out manner. Soil samples will be collected in two lines: an inner line approximately 25 feet from the edge of the estimated landfill boundary based on information collected during previous sampling activities, and an outer line approximately 50 feet from the edge of the landfill. (The approximate location of the edge of the estimated landfill boundary is shown in pink in Figure 2, and will be confirmed based on visual observations at the time of sampling. The purpose of the soil samples is to delineate the extent of any constituents associated with the site in the adjacent native soil. Therefore, it is necessary to estimate where the edge of the landfill is. Final sample locations may be adjusted if field observations indicate the location of the edge of the estimated landfill boundary differs from that shown in Figure 2.) All soil samples will be analyzed for full TCL/TAL parameters including PCBs as arcoclors. Certain SVOCs in the TCL will be analyzed by selective ion monitoring (SIM) to obtain a lower detection limit. If PCBs are detected, these samples may be analyzed for PCB congeners, dioxins, and furans. If the results of these analyses exceed the SRSs, samples from the outer line will be analyzed for the same parameters. If the results from the outer line also exceed the SRSs, additional sampling may be needed to complete delineation. All soil sample analyses are summarized in Table 1.

All samples at locations SS-159 through SS-164 will be collected and analyzed directly.

3.2.2 Soil Sampling Procedures

ARCADIS field personnel will advance soil borings to collect surface soil samples using a hand-driven Macrocore®. At each sampling location, field personnel will use hand tools (e.g., slide-hammer) to advance a 2-inch-diameter by 2-foot-long stainless steel Macrocore® fitted with a dedicated acetate liner to 1 foot bgs. The Macrocore® cutting shoe may be equipped with a disposable, plastic basket to increase recovery of loose material. Other sampling methods (e.g., hand auger, shovel) may be used to collect soil samples if conditions at a proposed sampling location do not allow for advancement of or adequate recovery with a hand-driven Macrocore®.

After the Macrocore® is advanced to the specified depth, field personnel will carefully extract the Macrocore® from the borehole to minimize soil loss, remove the acetate liner containing the soil core from the Macrocore®, cut the acetate liner open, and photograph the soil core. Field personnel will record the length of each recovered soil core in a field log book then score the soil core at 6-inch intervals and field screen with a photoionization detector (PID). PID readings will be recorded in a field log book. If other sampling methods are required to collect soil, field personnel will attempt to remove a volume of soil approximately 1 foot long and 3 to 6 inches thick from the surface interval (i.e., 0.0 to 1.0 foot bgs), while attempting to minimize soil disturbance. Field personnel will process this soil volume in the same manner as a soil core contained in a Macrocore® acetate liner, as described above.

One sample for VOC analysis will be collected from the 6-inch interval with the highest PID reading. If PID readings higher than background levels are not observed, or if PID readings were consistent throughout the length of a core, one sample for VOC analysis will be collected from 0.5 to 1.0 foot bgs, or from any zone indicating waste material or discolloration.

Following sample collection for VOC analysis, field personnel will continue characterizing the soil core. The soil's physical characteristics and other relevant visual observations will be recorded in a field log book. When soil characterization is complete, a composite sample for non-VOC parameters will be collected from the remaining soil in the soil core. Surface soil samples for non-VOC parameters will be collected using decontaminated, non-dedicated stainless steel hand-tools (e.g., spoons, scoops or trowels) and bowls. Field personnel will place surface soil samples in laboratory-supplied containers. Field personnel will document, label, package and ship soil samples in accordance with procedures provided in Worksheet #21 of the QAPP. Non-disposable sample equipment (e.g., stainless steel bowls and spoons, Macrocore®, hand-auger, shovel) will be decontaminated between uses at subsequent sampling locations in accordance with the Equipment Decontamination standard operating procedure presented in the QAPP.

Field personnel will advance the Macrocore® or other hand tool to 1 foot bgs until adequate sample volume is obtained or until it is determined that a surface soil sample cannot be collected due to lack of soil at a sampling location. Field personnel will advance the Macrocore® or other hand tool a maximum of four times within 5 to 10 feet of each proposed sampling location in an attempt to obtain adequate sample volume. If adequate sample volume cannot be obtained after four attempts, no sample will be collected at that particular sampling location. Soil sampling will be attempted at the secondary (step out) location.

Some sampling will take place in potential bog turtle habitat. Field personnel conducting sampling activities in potential bog turtle habitat will implement USFWS-recommended conservation measures as described in Section 3.1.1.

The locations of all soil samples will be recorded by ARCADIS using a GPS unit.

3.2.3 Soil Sample Analyses

Soil samples will be analyzed for the constituents indicated in Table 1. Soil samples collected at locations SS-125 through SS-158, and locations SS-159 though SS-164, which were requested by USEPA (USEPA letter of July 30, 2014), will be analyzed for full TCL/TAL parameters. Certain SVOCs in the TCL will be analyzed by SIM to obtain a lower detection limit. If PCBs are detected, in samples SS-159 through SS-164, up to two of these samples may be analyzed for PCB congeners, dioxins, and furans.

3.3 Installation and Sampling of Temporary Monitoring Wells

The purpose of the temporary monitoring wells is to delineate constituents detected in monitoring wells MW-3 and MW-10. Previous data indicate that certain VOCs are present at concentrations above their New Jersey Ground Water Quality Criteria (GWQCs) for Class 2 aquifers. The temporary wells will be used to help identify potential sources of the VOCs, and to help select the locations of permanent monitoring wells in these areas for future monitoring. The constituents found in monitoring wells MW-3 and MW-10 will also be delineated by pore-water, surface water and sediment sampling, as discussed in Sections 3.4, 3.6, and 3.7.

3.3.1 Temporary Monitoring Well Locations

The proposed temporary monitoring well locations are shown in Figure 3a and 3b. Approximately five temporary wells will be drilled in the area of monitoring well MW-3. They will be located both upgradient and downgradient of monitoring well MW-3 to help identify potential sources of VOCs in this monitoring well and to delineate their downgradient extent.

Approximately four temporary wells are proposed in the vicinity of monitoring well MW-10. These locations are upgradient of monitoring well MW-10 to help identify potential sources of the VOCs. Given its location near wetlands, temporary or permanent monitoring wells cannot be installed downgradient of well MW-10.

3.3.2 Temporary Monitoring Well Installation and Sampling Procedures

Temporary monitoring wells will be installed in accordance with the NJDEP procedure for passively placed narrow diameter points (PPNDPs; NJDEP, 1994). Using a Geoprobe^R, a licensed driller will advance a Macrocore® fitted with a dedicated acetate liner to approximately 3 to 5 feet below the water table. The soil in the acetate liner will be logged and screened in accordance with the procedures presented in Section 3.2.3. Soil samples may be collected if PID readings higher than background levels are observed. Soil samples will be analyzed for full TCL/TAL parameters. Certain SVOCs in the TCL will be analyzed by SIM to obtain a lower detection limit.

Given the proximity to surface water in these areas of the site, the total depth of the PPNDPs will likely be less than 10 feet bgs. After reaching the required depth, the Macrocore® will be removed. A 1-inch diameter schedule 40 PVC well screen with

0.010 slots and a solid end cap is then placed in the borehole, with the screen crossing the water table.

Prior to sampling, three to five volumes of the standing water in the PPNDP will be purged using a peristaltic pump, inertial pump, or small centrifugal pump. During purging, a multifunction water quality meter will be used to record field parameter measurements (pH, specific conductance, oxidation-reduction potential, temperature, turbidity and dissolved oxygen) at the beginning, middle, and end of purging, as well as following sample collection. Field parameters will be recorded on field purge logs. Samples will be collected using a bailer and transferred to laboratory prepared bottles. In addition to the unfiltered sample at each temporary monitoring well, a filtered sample will also be collected by passing the unfiltered groundwater through a 0.45 micron filter. All samples will be stored in coolers on ice under full chain of custody procedures for shipment to the laboratory. Field personnel will document, label, package and ship temporary monitoring well samples in accordance with procedures provided in Worksheet #21 of the QAPP.

The well screen will be removed no more than 48 hours after placement. The borehole will be backfilled with prehydrated bentonite. The location of each PPNDP will be recorded by ARCADIS using GPS.

Purge water generated during sampling of temporary monitoring wells will be collected and contained in 55-gallon drums and staged for waste characterization and subsequent disposal.

3.3.3 Analysis of Groundwater Samples from Temporary Monitoring Wells

Groundwater samples from temporary monitoring wells will be analyzed for full TCL/TAL metals (filtered and unfiltered) and cyanide. Certain SVOCs in the TCL will be analyzed by SIM to obtain a lower detection limit.

3.4 Pore-Water Sampling

3.4.1 Pore-Water Sampler Locations

The purpose of pore-water sampling is to delineate the potential migration of contaminants in groundwater from the area of monitoring well MW-10 to the southwest. The area southwest of MW-10 is wetlands with surface water during most of the year. Therefore, a monitoring well will not be installed. Surface water samples could be obtained in this area for comparison to groundwater results at MW-10; however, surface water is affected by precipitation, inflow from other areas, and other variables. Therefore, pore-water samples will be collected to delineate the contaminants in groundwater.

Two pore-water samplers will be installed in the sediment downgradient of well MW-10 to obtain samples beneath the wetlands. The proposed sampling locations are shown on Figure 3a.

3.4.2 Pore-Water Sampler Installation

Regenerated cellulose membrane samplers will be used to collect pore-water samples within the sediment column. The samplers will be constructed of regenerated cellulose membrane material installed in a 2-inch diameter slotted PVC casing with a closed drive point and a screw-on cap. It is anticipated that a 12-inch sampler will provide sufficient volume for analysis; the actual length may be adjusted based on laboratory volume requirements. The regenerated cellulose membrane will be prefilled with deoxygenated and deionized water.

The pore-water sampler will be hand pushed at each target locations until the sampler is fully submerged by sediment as close to the biologically active zone (0 to 0.5 feet) as possible. Two samplers may be installed at one of the proposed locations to provide adequate volume for quality assurance/quality control samples. Locations will be marked with weighted buoys and samplers will be left in place for 14 to 21 days to equilibrate before samples are collected.

3.4.3 Analysis of Pore-Water Samples

Pore-water samples will be analyzed for TCL VOCs and TAL Metals and cyanide.

3.5 Installation and Sampling of Permanent Monitoring Wells

3.5.1 Permanent Monitoring Well Locations

Approximate proposed locations for the permanent monitoring wells are shown in Figures 3a and 3b. The final locations of the permanent monitoring wells will be determined based on the results of the soil sampling and the temporary monitoring well samples. These data, and a proposal for the locations of the permanent monitoring wells, will be provided to the USEPA in an interim technical memorandum (discussed in Section 3.10) for review and approval. The permanent monitoring wells will be installed after USEPA approval of the proposed well locations.

3.5.2 Permanent Monitoring Well Installation Procedures

Monitoring wells will be installed using a track-mounted hollow stem auger drill rig equipped with 4.25-inch-inner-diameter augers. Total well depths should be less than 15 feet bgs, based on water-level observations during previous RI activities. Continuous soil samples will be collected during borehole advancement using a 2-inch-diameter, 4-foot-long a Macrocore® fitted with a dedicated acetate liner. Each sample will be field screened with a PID. PID readings, descriptions of the soil's physical characteristics and other relevant visual observations will be recorded in a field log book. Samples for laboratory analysis will not be collected from the split-spoon samples.

Monitoring wells be constructed of 2-inch-diameter flush-joint threaded schedule 40 PVC riser with a 10-foot length of 0.01-inch slotted PVC well screen. Each monitoring well will be constructed so that the static water level is approximately 2 feet below the top of the well screen. A washed silica sand pack will be placed in the annular space between the well screen and riser and the formation to approximately 2 feet above the top of the well screen, followed by a 2-foot layer of fine sand (#00) as a seal. Cement-bentonite grout will be installed in the remaining annular space. Each monitoring well will be finished at the ground surface with a lockable steel stick-up protective housing and set within a 2- by 2-foot concrete pad constructed using a wooden form. Each well will be capped with an expandable well cap and marked permanently with the monitoring well ID and well permit number.

Soil cutting generated during monitoring well installation activities will be contained in 55-gallon drums and staged for waste characterization and disposal.

3.5.3 Monitoring Well Development/Redevelopment

Each newly installed monitoring well will be developed to remove fine-grained material that may have settled in and around the well during installation and to verify that the monitoring well is hydraulically connected to the surrounding formation. Existing monitoring wells will be redeveloped to remove accumulated sediment and/or to reestablish hydraulic connection between the well and surrounding formation if more than 0.5 ft of sediment has accumulated in the well.

Well development will be conducted in accordance with applicable NJDEP guidance (NJDEP 2005). Water-level measurements, purge rates and observations of the water's characteristics (e.g., odor, turbidity) will be recorded in a field log book during the purging activity.

Water generated during monitoring well development/redevelopment activities will be contained in 55-gallon drums and staged for waste characterization and disposal.

3.5.4 Hydraulic Monitoring

3.5.4.1 Evaluation of Hydraulic Connection of Northern Ponds to Groundwater

A surface water gauge will be installed in the easternmost of the two small ponds located near the northern edge of the landfill (Figure 3a). A surface water gauge was previously installed in the westernmost of these two ponds during the RI activities. Water-level measurements will be collected manually using an electronic water-level indicator at existing monitoring MW-9 and proposed monitoring well MW-11 and each surface water gauge in these two small ponds once a month for 4 months to evaluate the relative elevation of surface water in each pond and groundwater. Precipitation data will be collected from a local weather station for the same period. A monitoring period of four months should be adequate to observe how water levels are affected by variation in precipitation amounts. The hydrologic connection between the two small ponds and groundwater will then be evaluated.

3.5.4.2 Site-Wide Groundwater Elevation Measurements

Synoptic groundwater level measurements will be collected from all new and existing monitoring wells prior to each round of groundwater sampling.

The depth to water will be measured from the surveyed measuring point at each well using an electronic water level indicator, and will be accurate to within 0.01 feet. In addition to the groundwater levels, surface water elevations will be measured in the two small ponds located near the northern edge of the estimated landfill boundary (Figure 3a), and the large pond near the western edge of the estimated landfill boundary (Figure 3b) prior to groundwater sampling.

3.5.5 Monitoring Well Sampling Procedures

Three groundwater sampling events will be conducted. The first groundwater sampling event will consist of the existing permanent wells, and will be conducted at approximately the same time as the soil, sediment, surface water, pore-water, and temporary monitoring well sampling. The second groundwater sampling event will be conducted at least two weeks following installation and development of the new monitoring wells, and will include all the new wells, and the existing monitoring wells as necessary depending on the results of the first event at these wells. The third event will consist of all the new monitoring wells (i.e., a second round of samples at these wells). The third groundwater sampling event will be conducted approximately 90 days after the second event.

Groundwater samples will be collected using low-flow purging and sampling procedures. A bladder pump equipped with a Teflon® bladder, assembled with Teflon® and stainless steel fittings, will be used for low-flow purging and sampling. Dedicated Teflon® tubing will be used to discharge groundwater from the bladder pump. The bladder pump will be lowered to the middle of the saturated screened interval of the monitoring well. During purging, a multifunction water quality meter equipped with an in-line flow-through cell will be used to record field parameter measurements (pH, specific conductance, oxidation-reduction potential, temperature, turbidity and dissolved oxygen). Purge rates will be maintained between approximately 100 and 250 milliliters per minute (mL/min) and adjusted to avoid drawdown in the well greater than 0.1 meter (0.33 foot) to the extent possible.

Once field parameters stabilize, the influent feed line will be removed from the flow-through assembly. One groundwater sample will be collected directly from the influent feed line and placed in laboratory-supplied containers. Field personnel will document, label, package and ship groundwater samples in accordance with procedures provided in Worksheet #21 of the QAPP.

Purge water generated during monitoring well sampling activities will be contained in 55-gallon drums and staged on site for waste characterization and disposal.

3.5.6 Analysis of Groundwater Samples from Permanent Monitoring Wells

Samples collected during the first monitoring event (all existing wells) will be analyzed for full TCL/TAL metals and cyanide (filtered and unfiltered). Samples collected from the existing monitoring wells during the second monitoring event will be analyzed as warranted depending on the results of the first monitoring event; a proposed list of analytes will be provided to USEPA in the Technical Memorandum described in Section 3.10. Samples collected from new monitoring wells during both the second and third monitoring events will be analyzed for full TCL/TAL metals and cyanide (filtered and unfiltered).

Groundwater data may be used to evaluate proposing monitored natural attenuation (MNA) as a remedy for groundwater. In support of this, additional data to characterize geochemical conditions in the aquifer may be obtained during the groundwater sampling. A list of proposed monitoring wells and analytical methods to be included in this sampling will be provided to USEPA before the sampling is conducted.

3.6 Surface Water Sampling

3.6.1 Surface Water Sampling Locations

Surface water samples will be collected from surface water bodies on the site that were not sampled during the previous investigations. In addition, surface water samples will be collected from a linear water body located southwest of the estimated landfill boundary, between monitoring wells MW-3 and MW-4. The proposed sampling locations are shown on Figures 3a and 3b and are summarized in Table 1. The order of sampling will be from downstream to upstream locations. All surface water samples will be co-located with sediment samples (Section 3.7), and will be collected prior to sediment samples to minimize turbidity in the water column.

The position of sample locations may be adjusted based on accessibility or on other information gathered during field activities. Some of the water bodies where sampling is proposed are small and have not been directly observed during previous activities at the site. They may be ephemeral or may be smaller than shown in the site figure, which is based on an aerial photograph taken in 2006. Surface water and sediment samples will be collected if any standing water is observed at the proposed sampling locations.

3.6.2 Surface Water Sampling Procedures

Surface water samples will be collected in accordance with sampling procedures developed based on USEPA, USEPA ERT, and NJDEP surface water sample collection guidance documents (USEPA 1996, 1995, 1994a; NJDEP 2005).

The total depth of the water column will be measured at each surface water sampling location using an electronic depth sounder, surveyor's rod, or tape measure. Samples analyzed for trace-mercury using laboratory analytical method Revision E: Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry for Mercury (USEPA Method 1631) will be collected using the "Clean Hands and Dirty Hands" procedural techniques recommended in *Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels – Method 1669* (USEPA 1996). These samples will be collected separately from the other sample parameters by a dedicated "Clean Hands and Dirty Hands" team using a peristaltic pump equipped with white polyethylene and styrene/ethylene/butylenes/silicone (SEBS) tubing. The remaining sample parameters will be collected following the collection of trace-mercury samples, using either dedicated laboratory-decontaminated bottleware, bottom-loading Teflon® bailers, a Bacon bomb sampler or a peristaltic pump equipped with dedicated Teflon®-lined polyethylene and medical-grade silicon tubing. The appropriate sampling method will be selected based on sample parameters and site conditions at the time of sample collection. Samples will be collected from the mid-point of the water column at each location. A peristaltic pump will not be used to collect surface water samples to be analyzed for VOCs. For metals analyses, both filtered and unfiltered surface water samples will be collected. Samples will be filtered by the analytical laboratory using a 0.45-micron disposable filter. Samples collected for trace-mercury analysis will be filtered by the analytical laboratory. Surface water samples will be transferred directly into laboratory-supplied containers. Field personnel will document, label, package and ship surface water samples in accordance with procedures provided in Worksheet #21 of the QAPP.

Following surface water sample collection activities at each sampling location, water-quality parameters (e.g., pH, temperature, conductivity, and turbidity) will be measured using a combination water-quality meter (e.g., Horiba U-10, or equivalent). Water-quality measurement results will be recorded in a field log book.

3.6.3 Analysis of Surface Water Samples

All surface water samples will be analyzed for full TCL/TAL, SVOCs SIM, low-level mercury, filtered TAL metals and cyanide, and hardness.

3.7 Sediment Sampling

3.7.1 Sediment Sample Locations

Sediment samples will be collected from surface water bodies on the site that were not sampled during the previous investigations. In addition, sediment samples will be collected from a linear water body located southwest of the estimated landfill boundary, between monitoring wells MW-3 and MW-4. The proposed sampling locations are shown on Figures 3a and 3b and are summarized in Table 1. The order of sampling will be from downstream to upstream locations. All sediment samples will be co-located with surface water samples (Section 3.6); sediment samples will be collected after surface water samples to minimize turbidity in the water column.

The position of sample locations may be adjusted based on accessibility or on other information gathered during field activities. Some of the water bodies where sampling is proposed are small and have not been directly observed during previous activities at the site. They may be ephemeral or may be smaller than shown in the site figure, which is based on an aerial photograph taken in 2006. In such cases, the samples may be collected elsewhere or eliminated.

3.7.2 Sediment Sampling Procedures

Sediment samples will be collected in accordance with sampling procedures developed based on USEPA, USEPA ERT, and NJDEP sediment sample collection guidance documents (USEPA 1995, 1994b; NJDEP 2005, 1998).

Sediment samples will be collected by advancing a dedicated Lexan® coring device or stainless steel Macrocore® sampler equipped with a dedicated acetate liner to a minimum of 1 foot beneath the surface water/sediment interface. One of these sampling methods will be selected based on site conditions at the time of sample collection. Each sediment core will be field screened with a PID. PID readings, descriptions of the sediment's physical characteristics, and other relevant visual observations will be recorded in a field log book. A sample for VOC analysis will be collected from the 0.5 to 1.0-foot interval in accordance with NJDEP (1998). Sediment in the 0.0 to 0.5-foot interval will then be homogenized and transferred directly into laboratory-supplied containers for other analytical parameters. Field personnel will document, label, package and ship sediment samples in accordance with procedures provided in Worksheet #21 of the QAPP.

3.7.3 Sediment Sample Analysis

All sediment samples will be analyzed for full TCL/TAL, SVOC SIM, pH, total organic carbon, and grain size.

3.8 Assessment of Hunt Club Well HC-1

Well HC-1 is the existing well which supplies water to a spigot located outside the Hunt Club building. The water is used for non-potable uses only. The well is located on the east side of Britten Road in the vicinity of the Hunt Club Building (Figure 2). A well permit from 1962 appears to be for the Hunt Club well. This permit indicates the proposed well depth was 150 feet bgs. However, the NJDEP does not have a record for this well.

A sample of the water from this well was collected in 2007 and analyzed for full TCL/TAL parameters. The results indicate that the only constituents present at concentrations above their GWQCs were iron (1,840 micrograms per liter [µg/L] compared to its GWQC of 300 µg/L) and manganese (951 µg/L, compared to its GWQC of 50 µg/L). The GWQCs for iron and manganese are based on USEPA Secondary Maximum Contaminant Limits (MCLs), which are based on aesthetic considerations such as taste, odor, and appearance.

The investigation of the Hunt Club well will include removing the pump and piping from the well and obtaining a video log to estimate the depth of the well casing, length of open hole or screened interval, and total depth of the well. This task will be conducted by a licensed well driller under observation by a geologist or engineer from ARCADIS.

The final disposition of the well will be decided after the investigation is complete. The Group may propose not to reinstall the pump and piping to prevent any potential future exposure and/or to use the well as a monitoring point, if its construction is suitable. The Group will discuss reinstallation options with the property owner before proceeding.

3.9 Analytical Procedures

All analyses will be performed by TestAmerica Laboratories, Inc. (TestAmerica) using current USEPA methods. TestAmerica is a current participant in the Contract Laboratory Program (CLP). The analytical procedures are included in Table 1.

Additional information on TestAmerica and the analytical procedures is provided in the QAPP.

3.10 Reporting

3.10.1 Interim Technical Memorandum

Prior to installation of the permanent monitoring wells, an interim technical memorandum will be prepared. The purpose of the interim technical memorandum will be to provide a basis to select locations for the permanent monitoring wells.

The interim technical memorandum will include non-validated analytical results from soil samples, temporary monitoring wells, sediment samples and surface water samples. It will also include maps showing the soil sample, sediment sample, surface water sample and temporary well locations and sampling logs. It will contain recommendations for the locations of permanent monitoring wells, and will be submitted to USEPA for review and approval before the permanent monitoring wells are installed.

3.10.2 Final Report

A final report will be prepared and submitted to USEPA for review as a standalone document. This report will also be incorporated into the RI report. The final report will include a discussion of the new validated data results for all surface soil, surface water, sediment, pore-water, and groundwater samples collected as part of the Data Gaps SAP. A revised conceptual site model will also be included.

4. Schedule

The Data Gaps SAP sampling has been divided into two phases to (1) obtain data needed to select permanent well locations and allow USEPA to review the proposed locations before installation; and (2) obtain data needed to support preparation of the BERA Work Plan in early 2015, allowing implementation of the BERA field sampling during the 2015 field season. The final locations of the seven proposed permanent monitoring wells depend on the results of the soil and temporary well sampling. The data needed to help develop the BERA Work Plan are the results of the soil, pore-water, surface water, and sediment samples. Therefore, these samples will be collected in Phase 1 of the Data Gaps SAP field implementation, and the results should be available in early 2015.

After Phase 1 is complete, an Interim Technical Memorandum proposing the permanent monitoring well locations will be submitted to the USEPA. After approval of the well locations, Phase 2 of the Data Gaps SAP will be implemented. It will consist of installation and sampling of new monitoring wells, and additional sampling of the existing monitoring wells.

Concurrently, after Phase 1 is complete, the soil, pore-water, surface water, and sediment results will be used to help finalize the BERA WP.

The following schedule provides additional detail. The actual schedule will depend on USEPA review and approval of deliverables provided by the Group, weather, access, subcontractor availability, and other factors.

<u>Phase 1 Field Work</u>

- Submittal of permit equivalencies – November 7, 2014
- Soil sample collection – November 17 through December 2, 2014
- Installation of pore-water samplers – November 18, 2014
- Temporary monitoring well installation and sampling – December 1 through December 5, 2014
- Surface water and sediment sampling – December 2 through December 11, 2014
- Recovery of pore-water samplers and sample collection – December 3, 2014
- Assessment of Hunt Club well HC-1 – December 5, 2014
- Redevelopment and sampling of existing wells – December 8 through December 19, 2015
- Sample analysis – November 18, 2014 through January 19, 2015

Data Review and Document Preparation

- Data validation – January 13, 2015 through February 12, 2015
- Preparation of Interim Technical Memorandum – December 12, 2014 through February 12, 2015
- Submit Interim Technical Memorandum to USEPA – February 13, 2015
- USEPA review of Interim Technical Memorandum – February 16 through March 6, 2015
- Receive USEPA approval of proposed permanent well locations – March 6, 2015

Phase 2 Field Work

- Obtain well permits – March 9 through March 27, 2015
- Install and develop proposed permanent wells – March 30 through April 10, 2015
- Second groundwater sampling event (all new monitoring wells, and selected existing monitoring wells based on the results of the first groundwater sampling even) – April 27 through May 7, 2015
- Third groundwater sampling event (all new monitoring wells) – July 27 through August 7, 2015
- Groundwater sample analysis – April 28 through September 7, 2015
- Evaluation of connection between northern ponds and groundwater – April 10 through August 14, 2015

Final Reporting

- Data validation – June 7 through September 21, 2015
- Begin preparation of final report – September 22, 2015
- Submit final report to USEPA – October 30, 2015

Development of the BERA Work Plan will begin after the results of the Phase 1 field work are received. Completion of this work plan, review of the work plan by USEPA, and implementation of the BERA will proceed in parallel with the implementation of the Data Gaps SAP. A schedule for the BERA will be provided in the BERA Work Plan.

5. Project Management

5.1 Staffing

Implementation of Data Gap SAP activities will require integration of personnel from various organizations, collectively referred to as the “Project Team.” Responsibilities of each member of the project team are presented in the QAPP.

A list of key project management personnel is provided below.

Company/Organization	Title	Name	Phone Number
USEPA	Remedial Project Manager	Tanya Mitchell	212-637-4362
USEPA	QA Manager	TBD	TBD
NJDEP	Case Manager	Jill McKenzie	609-292-1993
The Group	Primary Contact	Gary Fisher	908-582-5771
ARCADIS	Project Officer	John Persico	609-860-0590
ARCADIS	Project Manager	Suzanne Walls	865-777-3502
ARCADIS	QA Manager	Dennis Capria	315-446-2570

TBD – To be determined

5.2 Coordination

Personnel performing RI/FS Work Plan activities will be directed by representatives of the Project Team. A project organizational chart is provided as Figure 4.

6. References

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Weston Solutions Inc. 2003c. Sampling Trip Report - Rolling Knolls Landfill.

Table 1
Sample Locations, Depths, and Analyses
Data Gaps Sampling and Analysis Plan
Rolling Knolls Landfill Superfund Site
Chatham, New Jersey

				Laboratory Analyses													
Sample ID	**Sample Media**	**Depth Interval (Feet)**	**Sample Collection Method**	**VOCs**	**SVOCs**	**SVOCs - SIM**	**PCBs (as Aroclors)**	**Pesticides**	**TAL Metals and Cyanide**	**PCB Congeners, Dioxins, Furans**	**Full TCL/TAL**	**TAL Metals and Cyanide (unfiltered)**	**TAL Metals and Cyanide (filtered)**	**Low-Level Mercury**	**Hardness**	**pH, TOC, Grain Size**	**Notes**
Soil Samples																	
SS-125	Soil	0.0-1.0	Macrocore			X					X						
SS-126	Soil	0.0-1.0	Macrocore														*Contingent on sample SS-125
SS-127	Soil	0.0-1.0	Macrocore			X				X	X						
SS-128	Soil	0.0-1.0	Macrocore														*Contingent on sample SS-127
SS-129	Soil	0.0-1.0	Macrocore			X				X	X						
SS-130	Soil	0.0-1.0	Macrocore														*Contingent on sample SS-129
SS-131	Soil	0.0-1.0	Macrocore			X					X						
SS-132	Soil	0.0-1.0	Macrocore														*Contingent on sample SS-131
SS-133	Soil	0.0-1.0	Macrocore			X					X						
SS-134	Soil	0.0-1.0	Macrocore														*Contingent on sample SS-133
SS-135	Soil	0.0-1.0	Macrocore			X					X						
SS-136	Soil	0.0-1.0	Macrocore														*Contingent on sample SS-135
SS-137	Soil	0.0-1.0	Macrocore			X				X	X						
SS-138	Soil	0.0-1.0	Macrocore														*Contingent on sample SS-137
SS-139	Soil	0.0-1.0	Macrocore			X				X	X						
SS-140	Soil	0.0-1.0	Macrocore														*Contingent on sample SS-139
SS-141	Soil	0.0-1.0	Macrocore			X					X						
SS-142	Soil	0.0-1.0	Macrocore														*Contingent on sample SS-141
SS-143	Soil	0.0-1.0	Macrocore			X					X						

Table 1
Sample Locations, Depths, and Analyses
Data Gaps Sampling and Analysis Plan
Rolling Knolls Landfill Superfund Site
Chatham, New Jersey

				Laboratory Analyses													
Sample ID	Sample Media	Depth Interval (Feet)	Sample Collection Method	VOCs	SVOCs	SVOCs - SIM	PCBs (as Aroclors)	Pesticides	TAL Metals and Cyanide	PCB Congeners, Dioxins, Furans	Full TCL/TAL	TAL Metals and Cyanide (unfiltered)	TAL Metals and Cyanide (filtered)	Low-Level Mercury	Hardness	pH, TOC, Grain Size	Notes
SS-144	Soil	0.0-1.0	Macrocore														*Contingent on sample SS-143
SS-145	Soil	0.0-1.0	Macrocore			X					X						
SS-146	Soil	0.0-1.0	Macrocore														*Contingent on sample SS-145
SS-147	Soil	0.0-1.0	Macrocore			X					X						
SS-148	Soil	0.0-1.0	Macrocore														*Contingent on sample SS-147
SS-149	Soil	0.0-1.0	Macrocore			X					X						
SS-150	Soil	0.0-1.0	Macrocore														*Contingent on sample SS-149
SS-151	Soil	0.0-1.0	Macrocore			X					X						
SS-152	Soil	0.0-1.0	Macrocore														*Contingent on sample SS-151
SS-153	Soil	0.0-1.0	Macrocore			X					X						
SS-154	Soil	0.0-1.0	Macrocore														*Contingent on sample SS-153
SS-155	Soil	0.0-1.0	Macrocore			X					X						
SS-156	Soil	0.0-1.0	Macrocore														*Contingent on sample SS-155
SS-157	Soil	0.0-1.0	Macrocore			X					X						
SS-158	Soil	0.0-1.0	Macrocore														*Contingent on sample SS-157
SS-159	Soil	0.0-1.0	Macrocore			X				X	X						Congeners, dioxins, and furans will be analyzed on up to 2 samples if PCBs are detected in the TAL analysis.
SS-160	Soil	0.0-1.0	Macrocore			X				X	X						
SS-161	Soil	0.0-1.0	Macrocore			X				X	X						
SS-162	Soil	0.0-1.0	Macrocore			X				X	X						
SS-163	Soil	0.0-1.0	Macrocore			X				X	X						
SS-164	Soil	0.0-1.0	Macrocore			X				X	X						

Table 1
Sample Locations, Depths, and Analyses
Data Gaps Sampling and Analysis Plan
Rolling Knolls Landfill Superfund Site
Chatham, New Jersey

				Laboratory Analyses													
Sample ID	Sample Media	Depth Interval (Feet)	Sample Collection Method	VOCs	SVOCs	SVOCs - SIM	PCBs (as Aroclors)	Pesticides	TAL Metals and Cyanide	PCB Congeners, Dioxins, Furans	Full TCL/TAL	TAL Metals and Cyanide (unfiltered)	TAL Metals and Cyanide (filtered)	Low-Level Mercury	Hardness	pH, TOC, Grain Size	Notes
Temporary Monitoring Wells																	
TWP-1	Groundwater	TBD	Macrocore			X					X		X				
TWP-2	Groundwater	TBD	Macrocore			X					X		X				
TWP-3	Groundwater	TBD	Macrocore			X					X		X				
TWP-4	Groundwater	TBD	Macrocore			X					X		X				
TWP-5	Groundwater	TBD	Macrocore			x					X		X				
TWP-6	Groundwater	TBD	Macrocore			X					X		X				
TWP-7	Groundwater	TBD	Macrocore			X					X		X				
TWP-8	Groundwater	TBD	Macrocore			X					X		X				
TWP-9	Groundwater	TBD	Macrocore			X					X		X				
Permanent Monitoring Wells (Existing)																	
MW-1	Groundwater	14.5	Low flow			X					X		X				
MW-2	Groundwater	12.5	Low flow			X					X		X				
MW-3	Groundwater	12.5	Low flow			X					X		X				
MW-4	Groundwater	12.5	Low flow			X					X		X				
MW-5	Groundwater	12.5	Low flow			X					X		X				
MW-6	Groundwater	12.5	Low flow			X					X		X				
MW-7	Groundwater	12.5	Low flow			X					X		X				
MW-8	Groundwater	12.5	Low flow			X					X		X				
MW-9	Groundwater	12.5	Low flow			X					X		X				
MW-10	Groundwater	12.5	Low flow			X					X		X				
X-1	Groundwater	18	Low flow			X					X		X				

Table 1
Sample Locations, Depths, and Analyses
Data Gaps Sampling and Analysis Plan
Rolling Knolls Landfill Superfund Site
Chatham, New Jersey

Sample ID	Sample Media	Depth Interval (Feet)	Sample Collection Method	Laboratory Analyses													Notes
				VOCs	SVOCs	SVOCs - SIM	PCBs (as Aroclors)	Pesticides	TAL Metals and Cyanide	PCB Congeners, Dioxins, Furans	Full TCL/TAL	TAL Metals and Cyanide (unfiltered)	TAL Metals and Cyanide (filtered)	Low-Level Mercury	Hardness	pH, TOC, Grain Size	
X-2	Groundwater	20	Low flow			X					X		X				
X-3	Groundwater	23	Low flow			X					X		X				
X-4	Groundwater	15.5	Low flow			X					X		X				
X-5	Groundwater	13.2	Low flow			X					X		X				This well was not sampled during previous sampling activities due to a lack
X-6	Groundwater	13	Low flow			X					X		X				
X-7	Groundwater	8.7	Low flow			X					X		X				This well was not sampled during previous sampling activities due to a lack
Permanent Monitoring Wells (Proposed)																	
MW-11	Groundwater	TBD	Low flow			X					X		X				
MW-12	Groundwater	TBD	Low flow			X					X		X				
MW-13	Groundwater	TBD	Low flow			X					X		X				
MW-14	Groundwater	TBD	Low flow			X					X		X				
MW-15	Groundwater	TBD	Low flow			X					X		X				
MW-16	Groundwater	TBD	Low flow			X					X		X				
MW-17	Groundwater	TBD	Low flow			X					X		X				
Pore Water Samples																	
PW-1	Pore Water	0.0-0.5	PDB	X								X					
PW-2	Pore Water	0.0-0.5	PDB	X								X					
Surface Water Samples																	
SW-34	Surface Water	TBD	Teflon-lined bailer/direct dip			X					X		X	X	X		

Table 1
Sample Locations, Depths, and Analyses
Data Gaps Sampling and Analysis Plan
Rolling Knolls Landfill Superfund Site
Chatham, New Jersey

Sample ID	Sample Media	Depth Interval (Feet)	Sample Collection Method	Laboratory Analyses													Notes
				VOCs	SVOCs	SVOCs - SIM	PCBs (as Aroclors)	Pesticides	TAL Metals and Cyanide	PCB Congeners, Dioxins, Furans	Full TCL/TAL	TAL Metals and Cyanide (unfiltered)	TAL Metals and Cyanide (filtered)	Low-Level Mercury	Hardness	pH, TOC, Grain Size	
SW-35	Surface Water	TBD	Teflon-lined bailer/direct dip			X					X		X	X	X		
SW-36	Surface Water	TBD	Teflon-lined bailer/direct dip			X					X		X	X	X		
SW-37	Surface Water	TBD	Teflon-lined bailer/direct dip			X					X		X	X	X		
SW-38	Surface Water	TBD	Teflon-lined bailer/direct dip			X					X		X	X	X		
SW-39	Surface Water	TBD	Teflon-lined bailer/direct dip			X					X		X	X	X		
SW-40	Surface Water	TBD	Teflon-lined bailer/direct dip			X					X		X	X	X		
SW-41	Surface Water	TBD	Teflon-lined bailer/direct dip			X					X		X	X	X		
SW-42	Surface Water	TBD	Teflon-lined bailer/direct dip			X					X		X	X	X		
SW-43	Surface Water	TBD	Teflon-lined bailer/direct dip			X					X		X	X	X		
SW-44	Surface Water	TBD	Teflon-lined bailer/direct dip			X					X		X	X	X		

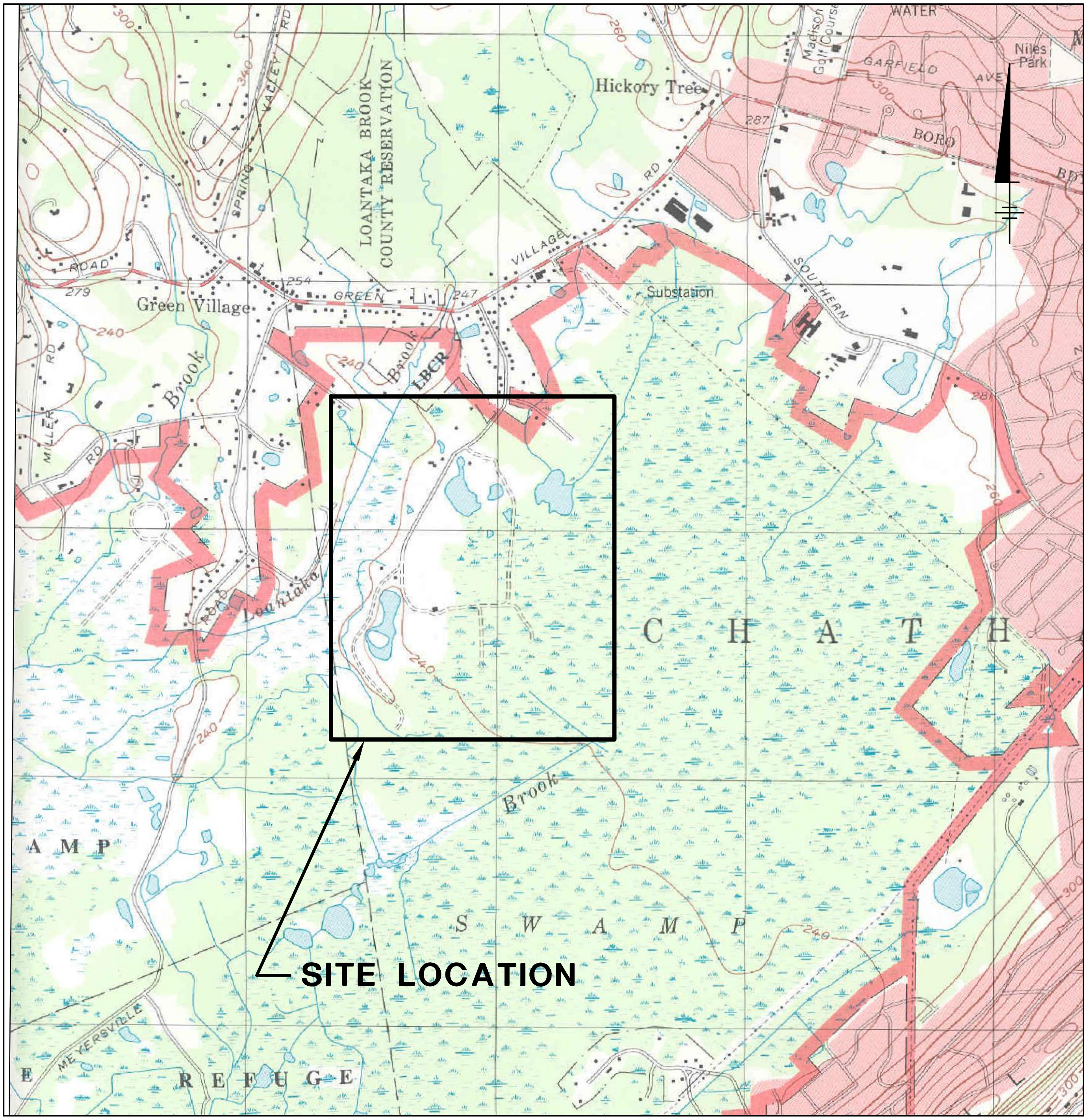
Table 1
Sample Locations, Depths, and Analyses
Data Gaps Sampling and Analysis Plan
Rolling Knolls Landfill Superfund Site
Chatham, New Jersey

Sample ID	Sample Media	Depth Interval (Feet)	Sample Collection Method	Laboratory Analyses: VOCs	SVOCs	SVOCs - SIM	PCBs (as Aroclors)	Pesticides	TAL Metals and Cyanide	PCB Congeners, Dioxins, Furans	Full TCL/TAL	TAL Metals and Cyanide (unfiltered)	TAL Metals and Cyanide (filtered)	Low-Level Mercury	Hardness	pH, TOC, Grain Size	Notes
Sediment Samples																	
SD-34	Sediment	0.0 - 1.0	Grab sample – Encore sampler			X					X					X	
SD-35	Sediment	0.0 - 1.0	Grab sample – Encore sampler			X					X					X	
SD-36	Sediment	0.0 - 1.0	Grab sample – Encore sampler			X					X					X	
SD-37	Sediment	0.0 - 1.0	Grab sample – Encore sampler			X					X					X	
SD-38	Sediment	0.0 - 1.0	Grab sample – Encore sampler			X					X					X	
SD-39	Sediment	0.0 - 1.0	Grab sample – Encore sampler			X					X					X	
SD-40	Sediment	0.0 - 1.0	Grab sample – Encore sampler			X					X					X	
SD-41	Sediment	0.0 - 1.0	Grab sample – Encore sampler			X					X					X	
SD-42	Sediment	0.0 - 1.0	Grab sample – Encore sampler			X					X					X	
SD-43	Sediment	0.0 - 1.0	Grab sample – Encore sampler			X					X					X	
SD-44	Sediment	0.0 - 1.0	Grab sample – Encore sampler			X					X					X	

Abbreviations:

VOCs = volatile organic compounds
SVOCs = semivolatile organic compound:
PCBs = polychlorinated biphenyls
PDB = passive diffusion bag
TCL = Target Compound List
TOC = total organic carbon
TAL= Target Analyte List

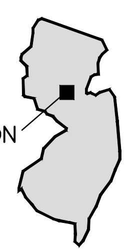
Sample analyses will be conducted using the following analytical methods:
Target Compound List organics (VOCs, SVOCs, PCBs and pesticides) via SOM01.2, *Contract Laboratory Program (CLP Statement of Work for Organic Ar*
Target Analyte List metals and cyanide via ISM01.3, *CLP Statement of Work for Inorganic Analyses*
PCB Congeners via USEPA Method 1668A, *Chlorinated Biphenyl Congeners in Water, Soil, Sediment and Tissue by HRGC/HRMS*
Dioxins and furans via USEPA Method 1613, *Dioxins and Furans in Water, Soil, Sediment and Tissue by HRGC/HRMS.*
Low-level mercury via USEPA Method 1631, Revision E.
Hardness via SM 2340C.
pH via USEPA Method 9045D.
TOC via the Lloyd Kahn method.
Grain size via ASTM D-422.



SOURCE:
CHATHAM QUADRANGLE, NJ
7.5 MINUTE SERIES
CONTOUR INTERVAL 20 FEET

0 2000' 4000'
GRAPHIC SCALE

AREA LOCATION



NEW JERSEY

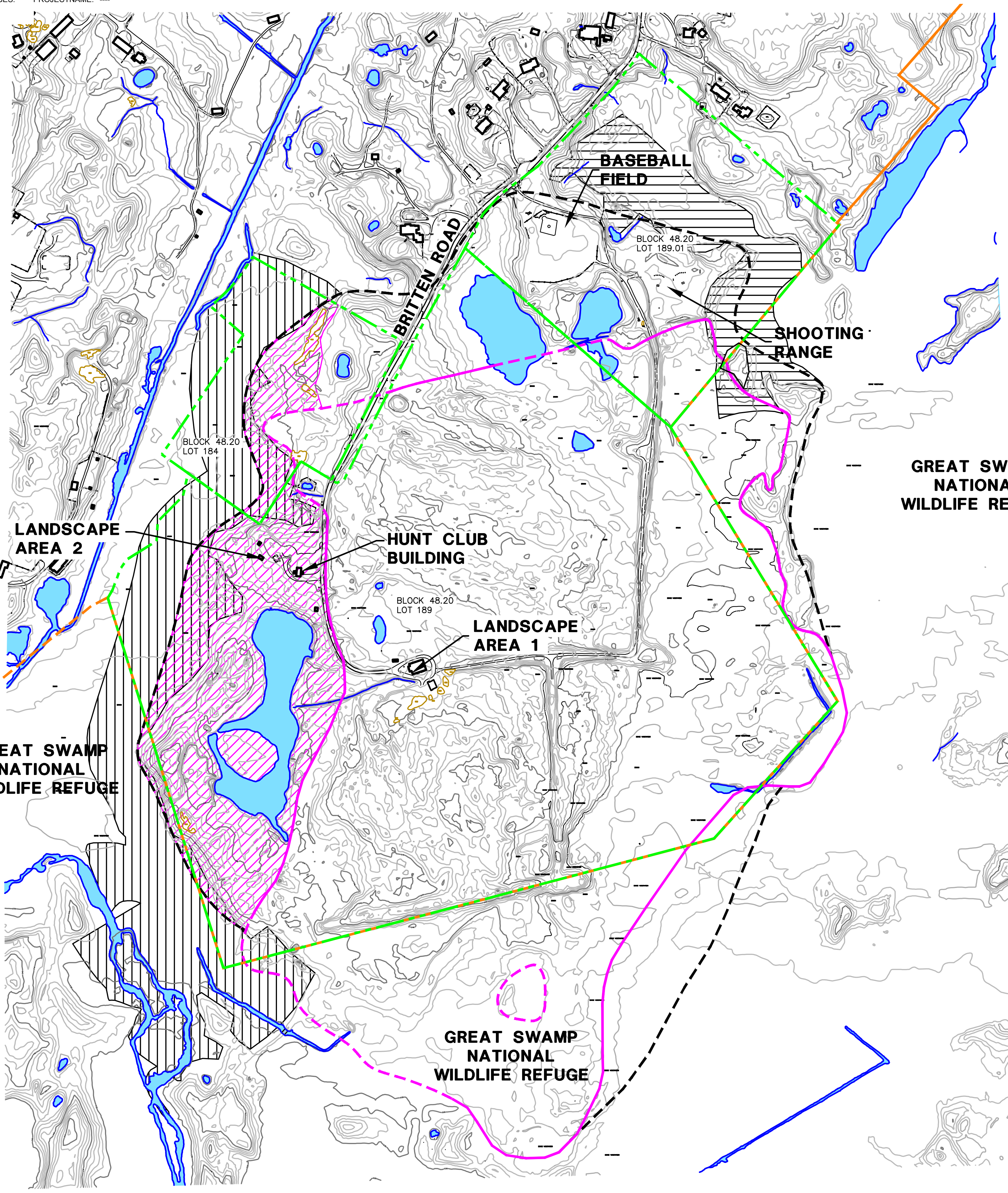
ROLLING KNOLLS LANDFILL SUPERFUND SITE
CHATHAM, NEW JERSEY
DATA GAPS SAMPLING AND ANALYSIS PLAN

SITE LOCATION

ARCADIS

FIGURE
1

CITY: CRANBURY-NJ DIV/GROUP: ENVCAD DB: TFATTO LD: TFATTO PIC: PM: K.ROMAINE TM:K.ROMAINE LYR: ON=*;OFF=*REF*
G:\ENVCAD\CRANBURY\ACT\B0033203\0003\00110\33203N01.dwg LAYOUT: 1 SAVED: 9/16/2014 11:41 AM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 9/16/2014 11:41 AM BY: MEYER, JULIE
XREFS: IMAGES: 33203X01.jpg PROJECTNAME: ----



NOTES:

1. THE PRE–REMEDIAL INVESTIGATION PROJECTED EDGE OF LANDFILLED MATERIALS ON THIS FIGURE IS APPROXIMATE AS DRAWN AND IS BASED ON VISUAL OBSERVATIONS OF THE GROUND SURFACE MADE DURING SITE VISITS CONDUCTED JUNE 20, 2006 THROUGH JULY 14, 2006.
2. THE EDGE OF LANDFILLED WASTES OBSERVED DURING TEST PIT ACTIVITIES IS DRAWN BASED ON OBSERVATIONS OF MATERIALS EXCAVATED DURING TEST PIT ACTIVITIES CONDUCTED FROM JULY 26, 2007 TO SEPTEMBER 6, 2007 AND MARCH 26, 2008.
3. THE PORTION OF THE GREAT SWAMP NATIONAL WILDLIFE REFUGE (GSNWR) PROPERTY BOUNDARY ON THIS FIGURE WITHIN CHATHAM TOWNSHIP, NJ WAS OBTAINED FROM CHATHAM TOWNSHIP TAX PARCEL DATA PROVIDED BY CIVIL SOLUTIONS. THE PORTION OF THE GSNWR PROPERTY BOUNDARY ON THIS FIGURE OUTSIDE OF CHATHAM TOWNSHIP IS APPROXIMATE AND WAS OBTAINED FROM THE UNITED STATES FISH AND WILDLIFE SERVICE (GEOGRAPHIC INFORMATION SYSTEMS AND SPATIAL DATA).
4. BLOCK 48.20, LOTS 184 AND 189 ARE OWNED BY ROBERT J. MIELE AS TRUSTEE FOR THE TRUST CREATED BY THE LAST WILL AND TESTAMENT OF ANGELO J. MIELE. BLOCK 48.20, LOT 189.01 IS OWNED BY THE GREEN VILLAGE FIRE DEPARTMENT.

LEGEND:

- OPEN WATER
- PRE–REMEDIAL INVESTIGATION PROJECTED EDGE OF LANDFILLED MATERIALS
- EDGE OF LANDFILLED WASTES OBSERVED DURING TEST PIT ACTIVITIES (DASHED WHERE APPROXIMATE)
- GREAT SWAMP NATIONAL WILDLIFE REFUGE PROPERTY BOUNDARY (DASHED WHERE APPROXIMATE)
- TAX PARCELS
- WASTE AND DEBRIS OBSERVED ON GROUND SURFACE BUT NOT OBSERVED OR ANTICIPATED TO BE BELOW GROUND SURFACE
- POTENTIAL BOG TURTLE HABITAT AREA A (35.31 ACRES)
- POTENTIAL BOG TURTLE HABITAT AREA B (10.89 ACRES)

SOURCES:

1. BASEMAP FROM JAMES M. STEWART INC., LAND SURVEYORS, PHILADELPHIA, PA., (ELECTRONIC FILE: 292406.DWG DATED: 6/30/06)
2. TAX PARCEL DATA FOR CHATHAM TOWNSHIP WAS PROVIDED BY CIVIL SOLUTIONS.

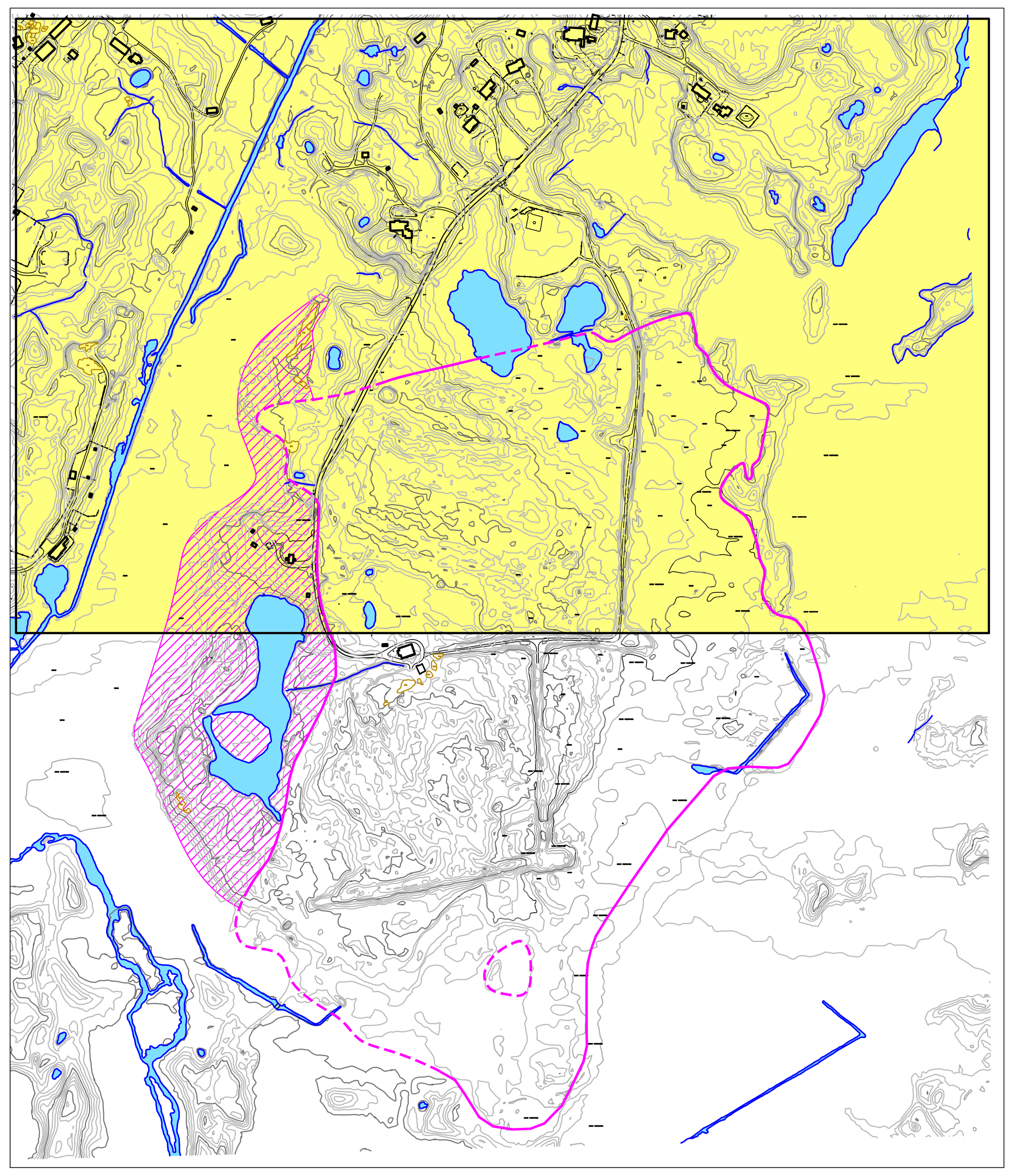
0 500' 1000'
GRAPHIC SCALE

ROLLING KNOLLS LANDFILL SUPERFUND SITE
CHATHAM, NEW JERSEY
DATA GAPS SAMPLING AND ANALYSIS PLAN

SITE PLAN

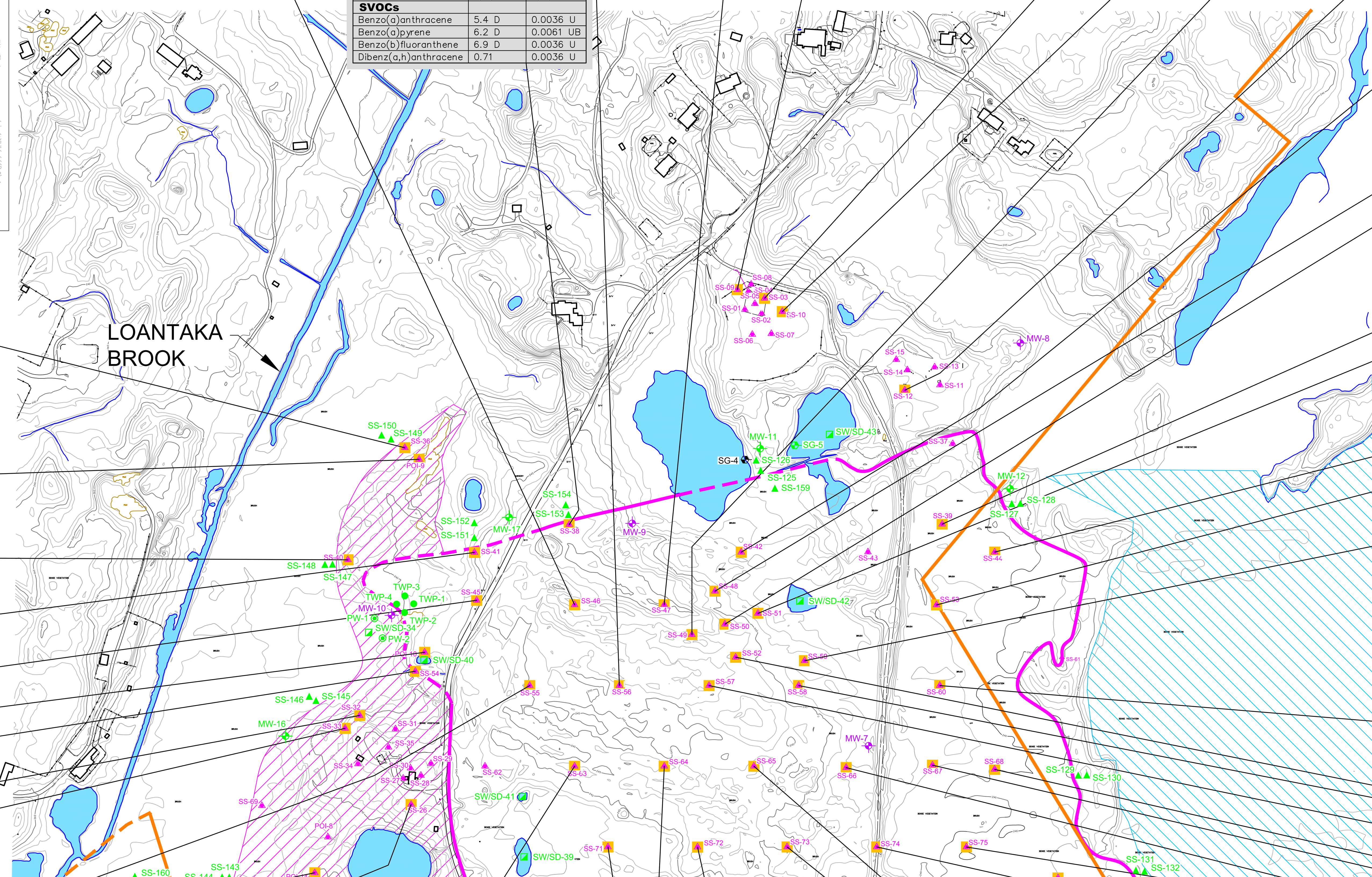
ARCADIS

FIGURE
2



SITE MAP

0 500' 1000'
GRAPHIC SCALE



SS-36	
Depth(Feet)	(0 – 1)
Date	8/31/2009
SVOCs	
Benzo(a)anthracene	2.2
Benzo(a)pyrene	2.3
Benzo(b)fluoranthene	3.1
Dibenz(a,h)anthracene	0.51 EJ
PCBs (Aroclors)	
Aroclor–1254	1.5 DJ
Total PCBs (Aroclors)	2.06 J
Metals	
Lead	2,910

SS-40	
Depth(Feet)	(0 – 1)
Date	8/31/2009
SVOCs	
Benzo(a)pyrene	0.25 J
PCBs (Aroclors)	
Aroclor–1254	1.3 D
Total PCBs (Aroclors)	1.56
Pesticides	
alpha–Chlordane	2.5 D
gamma–Chlordane	2.3 D
Metals	
Lead	825

POI-10	
Depth(Feet)	(0 – 1)
Date	8/26/2009
PCBs (Aroclors)	
Aroclor–1254	3.6 JN
Aroclor–1260	88 D
Total PCBs (Aroclors)	91.6 J
PCBs (Congeners)	
Total PCBs (Congeners)	2.05 J
Metals	
Copper	49,900 J
Lead	1,510 J

SS-32	
Depth(Feet)	(0 – 1)
Date	11/6/2007
SVOCs	
Benzo(a)pyrene	1 J

SS-55		
Depth(Feet)	(0 – 1)	(2 – 3)
Date	9/1/2009	9/1/2009
SVOCs		
Benzo(a)pyrene	0.3 J	0.17 J
PCBs (Aroclors)		
Aroclor–1248	1.5 DJ	0.049 U
Aroclor–1254	1.4 D	0.73
Total PCBs (Aroclors)	3.54 J	1.81
Metals		
Antimony	1,960 J	2.8 J
Arsenic	529 J	8.4 J
Lead	16,500	934

POI-9	
Depth(Feet)	(0 – 1)
Date	8/27/2009
SVOCs	
Benzo(a)anthracene	30 DJ
Benzo(a)pyrene	33 DJ
Benzo(b)fluoranthene	42 DJ
Benzo(k)fluoranthene	24 DJ
Dibenz(a,h)anthracene	5 J
Indeno(1,2,3–cd)pyrene	13 J
PCBs (Aroclors)	
Total PCBs (Aroclors)	1.97 J
Metals	
Lead	7,900 J

SS-41	
Depth(Feet)	(0 – 1)
Date	8/27/2009
SVOCs	
Benzo(a)pyrene	0.26

SS-45		
Depth(Feet)	(0 – 1)	(9 – 10)
Date	8/31/2009	8/31/2009
SVOCs		
Benzo(a)pyrene	0.77	0.006

SS-54	
Depth(Feet)	(0 – 1)
Date	8/31/2009
SVOCs	
Benzo(a)pyrene	0.22 [0.24]

SS-33	
Depth(Feet)	(0 – 1)
Date	11/6/2007
SVOCs	
Benzo(a)pyrene	0.39

POI-14	
Depth(Feet)	(0 – 1)
Date	8/24/2009
Metals	
Arsenic	31.7 J
Lead	9,210 J

SS-46		
Depth(Feet)	(0 – 1)	(6 – 7)
Date	9/1/2009	9/1/2009
SVOCs		
Benzo(a)pyrene	0.54 J	0.25 EJ
PCBs (Aroclors)		
Aroclor–1242	16 DJ	0.054 U
Aroclor–1254	12 DJ	1.2 D
Aroclor–1260	1.2 J	0.14
Aroclor–1268	2.8 J	0.067
Total PCBs (Aroclors)	32 J	2.03
PCBs (Congeners)		
Total PCBs (Congeners)	95 J	NA
Metals		
Arsenic	7 J	24.5 J
Lead	665	1,460

SS-56		
Depth(Feet)	(0 – 1)	(2 – 3)
Date	8/26/2009	8/26/2009
PCBs (Aroclors)		
Aroclor–1242	3 D	4.1 D
Aroclor–1254	7.2 D	4 D
Aroclor–1260	1.2	0.97
Total PCBs (Aroclors)	11.4	9.07
Pesticides		
Dieldrin	0.3 D	0.041 J
Metals		
Arsenic	14.6 J	20.6 J
Lead	2,060 J	1,120 J

SS-38		
Depth(Feet)	(0 – 1)	(9 – 10)
Date	9/1/2009	9/1/2009
SVOCs		
Benzo(a)anthracene	5.4 D	0.0036 U
Benzo(a)pyrene	6.2 D	0.0061 UB
Benzo(b)fluoranthene	6.9 D	0.0036 U
Dibenz(a,h)anthracene	0.71	0.0036 U

SS-47		
Depth(Feet)	(0 – 1)	(8 – 9)
Date	8/31/2009	8/31/2009
SVOCs		
Benzo(a)pyrene	0.2 J	0.21 J
PCBs (Aroclors)		
Aroclor–1254	3 D	0.61
Aroclor–1260	1.5 D	0.13
Total PCBs (Aroclors)	5.35	1.47 J
Metals		
Arsenic	23.1	5.5 J
Lead	7,140	835

SS-09	
Depth(Feet)	(0 – 1)
Date	9/20/2007
SVOCs	
Benzo(a)pyrene	1

SS-03	
Depth(Feet)	(0 – 1)
Date	9/19/2007
SVOCs	
Benzo(a)pyrene	0.92

SS-10	
Depth(Feet)	(0 – 1)
Date	9/20/2007
SVOCs	
Benzo(a)pyrene	0.74 D

SS-49	
Depth(Feet)	(0 – 1)
Date	8/31/2009
SVOCs	
Benzo(a)pyrene	1.7
Benzo(b)fluoranthene	2.4
Dibenz(a,h)anthracene	0.25 EJ
PCBs (Aroclors)	
Aroclor–1248	1.6 D
Aroclor–1254	2.7 D
Aroclor–1260	1.3 D
Total PCBs (Aroclors)	5.6
Metals	
Arsenic	21.1
Lead	1,010

SS-12	
Depth(Feet)	(0 – 1)
Date	9/20/2007
SVOCs	
Benzo(a)pyrene	0.77 D

SS-42	
Depth(Feet)	(0 – 1)
Date	8/28/2009
PCBs (Aroclors)	
Aroclor–1254	1.3 D
Total PCBs (Aroclors)	1.84

SS-48	
Depth(Feet)	(0 – 1)
Date	8/28/2009
SVOCs	
Benzo(a)pyrene	0.27 EJ
PCBs (Aroclors)	
Aroclor–1248	1.4 D
Aroclor–1254	2.4 D
Total PCBs (Aroclors)	4.4
Metals	
Lead	1,300

SS-50	
Depth(Feet)	(0 – 1)
Date	8/28/2009
PCBs (Aroclors)	
Aroclor–1254	2.3 D
Aroclor–1260	1.1
Total PCBs (Aroclors)	3.4
Metals	
Arsenic	19.1 J

SS-39	
Depth(Feet)	(0 – 1)
Date	9/16/2009
SVOCs	
Benzo(a)pyrene	0.41
PCBs (Aroclors)	
Aroclor–1242	6.1
Aroclor–1254	6.2
Total PCBs (Aroclors)	12.3
PCBs (Congeners)	
Total PCBs (Congeners)	100 J
Metals	
Lead	1,050

SS-51	
Depth(Feet)	(0 – 1)
Date	8/28/2009
SVOCs	
Benzo(a)pyrene	0.44
PCBs (Aroclors)	
Aroclor–1248	1.6 D
Aroclor–1254	3 D
Total PCBs (Aroclors)	5.45
Metals	
Lead	2,200

SS-44	
Depth(Feet)	(0 – 1)
Date	9/1/2009
PCBs (Aroclors)	
Aroclor–1254	1.1 D
Total PCBs (Aroclors)	1.83
Metals	
Lead	1,580

SS-53	
Depth(Feet)	(0 – 1)
Date	9/17/2009
SVOCs	
Benzo(a)pyrene	0.57
PCBs (Aroclors)	
Aroclor–1242	4.1
Aroclor–1254	5.6
Aroclor–1260	1.2
Total PCBs (Aroclors)	10.9
Metals	
Lead	1,110 J

SS-59	
Depth(Feet)	(0 – 1)
Date	8/27/2009
PCBs (Aroclors)	
Aroclor–1242	6.5 D
Aroclor–1254	2.7 D
Total PCBs (Aroclors)	10
Metals	
Lead	1,250 J

SS-60	
Depth(Feet)	(0 – 1)
Date	9/18/2009
PCBs (Aroclors)	
Aroclor–1248	1.2 J
Aroclor–1254	3.6 J
Aroclor–1260	1.2 J
Total PCBs (Aroclors)	6 J
Pesticides	
Dieldrin	0.29 DJ
Metals	
Lead	974

SS-52	
Depth(Feet)	(0 – 1)
Date	8/31/2009
SVOCs	
Benzo(a)anthracene	2.7
Benzo(a)pyrene	3.2 J
Benzo(b)fluoranthene	4.2 J
Dibenz(a,h)anthracene	0.58 EJ
PCBs (Aroclors)	
Aroclor–1242	9.4 D
Aroclor–1254	5.3 D
Total PCBs (Aroclors)	15.4
PCBs (Congeners)	
Total PCBs (Congeners)	12.4 J
Metals	
Lead	2,850

SS-58	
Depth(Feet)	(0 – 1)
Date	8/28/2009
PCBs (Aroclors)	
Aroclor–1248	67 D
Aroclor–1254	57 D
Aroclor–1260	1.7
Total PCBs (Aroclors)	126
PCBs (Congeners)	
Total PCBs (Congeners)	157 J
Pesticides	
Aldrin	0.27 DJN
Metals	
Lead	927

SS-57		
Depth(Feet)	(0 – 1)	(4 – 5)
Date	8/27/2009	8/27/2009
SVOCs		
Benzo(a)pyrene	2.3	0.38 J
Benzo(b)fluoranthene	3.6	0.58 J
Dibenz(a,h)anthracene	0.17 J	0.69 EJ
PCBs (Aroclors)		
Aroclor–1248	2.8 D	4.2 D
Aroclor–1254	2.7 DJN	4.6 D
Aroclor–1260	7 D	3.3 D
Total PCBs (Aroclors)	12.5 J	12.1
Pesticides		
Heptachlor epoxide	RX	0.33 DJN
Metals		
Lead	795 J	1,060 J

SS-26	
Depth(Feet)	(0 – 1)
Date	11/5/2007
SVOCs	
Benzo(a)pyrene	0.23 J

SS-63		
Depth(Feet)	(0 – 1)	(3.5 – 4.5)
Date	8/26/2009	8/26/2009
SVOCs		
Benzo(a)pyrene	0.26	0.19 EJ
PCBs (Aroclors)		
Aroclor–1242	0.24 U	2.8 D
Aroclor–1248	7.7 DJ	0.074 U
Aroclor–1254	5.3 DJ	4 D
Total PCBs (Aroclors)	13.9 J	7.44
PCBs (Congeners)		
Total PCBs (Congeners)	44.1 J	NA
Metals		
Arsenic	19.3 J	24.3 J
Lead	2,020 J	2,520 J

SS-71	
Depth(Feet)	(0 – 1)
Date	8/26/2009
PCBs (Aroclors)	
Total PCBs (Aroclors)	1.1 J
Metals	
Lead	1,070 J
Vanadium	6,140

SS-72		
Depth(Feet)	(0 – 1)	(9 – 10)
Date	8/25/2009	8/25/2009
PCBs (Aroclors)		
Aroclor–1242	0.11 U	1.8
Aroclor–1248	2.5 D	0.11 U
Aroclor–1254	3.3 D	3.9 D
Total PCBs (Aroclors)	7.07 J	6.09
PCBs (Congeners)		
Total PCBs (Congeners)	8.65 J	NA
Metals		
Arsenic	26 J	12.6 J
Lead	1,750 J	950 J

SS-65		
Depth(Feet)	(0 – 1)	(5 – 6)
Date	8/27/2009	8/27/2009
SVOCs		
Acetophenone	18 D	0.05 J
Benzo(a)anthracene	66 D	0.86
Benzo(a)pyrene	51 D	0.88
Benzo(b)fluoranthene	49 D	1.2
Benzo(k)fluoranthene	51 D	1.3
Dibenz(a,h)anthracene	4.8 J	0.44 EJ
Indeno(1,2,3–cd)pyrene	12 J	0.15 J
PCBs (Aroclors)		
Aroclor–1242	0.065 U	4.2 DJ
Aroclor–1248	1.8 D	0.15 U
Aroclor–1254	1.5 DJ	3 D
Total PCBs (Aroclors)	3.68 J	7.73 J
Metals		
Lead	1,560 J	3,380 J

SS-75	
Depth(Feet)	(0 – 1)
Date	9/15/2009
PCBs (Aroclors)	
Aroclor–1248	1.3
Aroclor–1254	2.3
Total PCBs (Aroclors)	4.17
Metals	
Arsenic	32.3
Lead	1,360

SS-77	
Depth(Feet)	(0 – 1)
Date	9/17/2009
PCBs (Aroclors)	
Aroclor–1248	1.7
Total PCBs (Aroclors)	2.16 J

SS-66	
Depth(Feet)	(0 – 1)
Date	8/28/2009
SVOCs	
Benzo(a)pyrene	0.28
PCBs (Aroclors)	
Aroclor–1248	15
Aroclor–1254	55 D
Aroclor–1260	8.1
Total PCBs (Aroclors)	78.1
PCBs (Congeners)	
Total PCBs (Congeners)	9.66 J
Metals	
Arsenic	21.9
Lead	2,100

SS-68	
Depth(Feet)	(0 – 1)
Date	9/2/2009
SVOCs	
Benzo(a)pyrene	0.32 [0.18 EJ]
PCBs (Aroclors)	
Aroclor–1248	1.2 DJ [1.3 DJ]
Aroclor–1254	3.2 D [2.6 D]
Total PCBs (Aroclors)	4.99 J [4.41 J]
PCBs (Congeners)	
Total PCBs (Congeners)	4.91 J [9.46 J]
Metals	
Lead	1,320 [1,150]

SS-67	
Depth(Feet)	(0 – 1)
Date	9/3/2009
SVOCs	
Benzo(a)pyrene	0.49
PCBs (Aroclors)	
Total PCBs (Aroclors)	1.32 J
Metals	
Lead	1,580

SS-64		
Depth(Feet)	(0 – 1)	(5 – 6)
Date	8/27/2009	8/27/2009
SVOCs		
Dibenz(a,h)anthracene	0.21 EJ	0.49 EJ [0.36 EJ]
PCBs (Aroclors)		
Aroclor–1242	0.061 U	0.061 U [2.6 D]
Aroclor–1248	2.1 D	3.2 DJ [0.11 U]
Aroclor–1254	1.5 D	2.3 DJ [4.9 D]
Total PCBs (Aroclors)	3.99	6.32 J [8.24]
Metals		
Lead	1,930 J	1,020 J [1,130 J]

SS-73		
Depth(Feet)	(0 – 1)	(6 – 7)
Date	8/25/2009	8/25/2009
SVOCs		
Benzo(a)pyrene	0.12 EJ	0.24 J
PCBs (Aroclors)		
Aroclor–1242	0.11 U	1.7
Aroclor–1248	1.3	0.19 U
Aroclor–1254	2.5 D	1.3 J
Total PCBs (Aroclors)	4.49	3.16 J
Metals		
Lead	1,880 J	3,020 J

SS-74		
Depth(Feet)	(0 – 1)	(6 – 7)
Date	8/24/2009	8/24/2009
SVOCs		
Benzo(a)anthracene	1	2.2
Benzo(a)pyrene	1.1	2.7
Benzo(b)fluoranthene	1.2	3.8 D
Dibenz(a,h)anthracene	0.3 EJ	0.76 EJ
PCBs (Aroclors)		
Aroclor–1254	0.039 U	1.3 D
Total PCBs (Aroclors)	0.211 J	2.17

Nonresidential Soil Remediation Standards	
Constituent	Value
VOCs	
Carbon Tetrachloride	2
Chloroform	2
SVOCs	
Acetophenone	5
Benzo(a)anthracene	2
Benzo(a)pyrene	0.2
Benzo(b)fluoranthene	2
Benzo(k)fluoranthene	23
Dibenz(a,h)anthracene	0.2
Indeno(1,2,3–cd)pyrene	2
PCBs	
Aroclor–1242	1
Aroclor–1248	1
Aroclor–1254	1
Aroclor–1260	1
Aroclor–1262	1
Aroclor–1268	1
Total PCBs (Aroclors)	1
PCBs (Congeners)	
Total PCBs (Congeners)	1
Pesticides	
Aldrin	0.2
alpha–Chlordane	1
Dieldrin	0.2
gamma–Chlordane	1
Heptachlor	0.7
Heptachlor epoxide	0.3
Metals	
Antimony	450
Arsenic	19
Cadmium	78
Copper	45,000
Lead	800
Manganese	5,900
Mercury	65
Vanadium	1,100

LEGEND:

- OPEN WATER
- EDGE OF LANDFILLED WASTES OBSERVED DURING TEST PIT ACTIVITIES (DASHED WHERE APPROXIMATE)
- GREAT SWAMP NATIONAL WILDLIFE REFUGE PROPERTY BOUNDARY (DASHED WHERE APPROXIMATE)
- WASTE AND DEBRIS OBSERVED ON GROUND SURFACE BUT NOT OBSERVED OR ANTICIPATED TO BE BELOW GROUND SURFACE
- AREAS WHERE SURFACE WATER FLOW DOES NOT EXHIBIT TYPICAL BED AND BANK MORPHOLOGY
- SOIL SAMPLING LOCATION
- SOIL SAMPLING LOCATION WITH DETECTED CONCENTRATIONS GREATER THAN NJDEP NONRESIDENTIAL SOIL REMEDIATION STANDARDS
- PROPOSED MONITORING WELL
- EXISTING MONITORING WELL
- PROPOSED TEMPORARY WELL POINT
- PROPOSED SOIL SAMPLE
- PROPOSED SURFACE WATER AND SEDIMENT SAMPLE
- PROPOSED POREWATER SAMPLE
- EXISTING STREAM GAUGE
- PROPOSED STREAM GAUGE

DATA NOTES:

UNITS = MILLIGRAMS PER KILOGRAM

[] = DUPLICATE SAMPLE

PCBS = POLYCHLORINATED BIPHENYLS

SVOCS = SEMIVOLATILE ORGANIC COMPOUNDS

VOCS = VOLATILE ORGANIC COMPOUNDS

NA = NOT ANALYZED

D = CONCENTRATIONS IDENTIFIED FROM ANALYSIS OF THE SAMPLE AT A SECONDARY DILUTION.

E = THE COMPOUND WAS QUANTITATED ABOVE THE CALIBRATION RANGE.

J = THE COMPOUND WAS POSITIVELY IDENTIFIED; HOWEVER, THE ASSOCIATED NUMERICAL VALUE IS AN ESTIMATED CONCENTRATION ONLY.

JN = THE ANALYSIS INDICATES THE PRESENCE OF A COMPOUND FOR WHICH THERE IS PRESUMPTIVE EVIDENCE TO MAKE A TENTATIVE IDENTIFICATION. THE ASSOCIATED NUMERICAL VALUE IS AN ESTIMATED CONCENTRATION ONLY.

U = THE COMPOUND WAS ANALYZED FOR BUT NOT DETECTED. THE ASSOCIATED VALUE IS THE COMPOUND QUANTITATION LIMIT.

RX = THE SAMPLE RESULTS ARE REJECTD DUE TO MATRIX INTERFERENCE.

NOTES:

1. ANALYTICAL RESULTS GIVEN IN MILLIGRAMS PER KILOGRAM FOR SOIL SAMPLES WITH DETECTED CONCENTRATIONS GREATER NEW JERSEY NONRESIDENTIAL SOIL REMEDIATION STANDARDS (DATED OCTOBER 2011).
2. THE EDGE OF LANDFILLED WASTES OBSERVED DURING TEST PIT ACTIVITIES IS DRAWN BASED ON OBSERVATIONS OF MATERIALS EXCAVATED DURING TEST PIT ACTIVITIES CONDUCTED FROM JULY 26, 2007 TO SEPTEMBER 6, 2007 AND MARCH 26, 2008.
3. THE PORTION OF THE GREAT SWAMP NATIONAL WILDLIFE REFUGE (GSNWR) PROPERTY BOUNDARY ON THIS FIGURE WITHIN CHATHAM TOWNSHIP, NJ WAS OBTAINED FROM CHATHAM TOWNSHIP TAX PARCEL DATA PROVIDED BY CIVIL SOLUTIONS. THE PORTION OF THE GSNWR PROPERTY BOUNDARY ON THIS FIGURE OUTSIDE OF CHATHAM TOWNSHIP IS APPROXIMATE AND WAS OBTAINED FROM THE UNITED STATES FISH AND WILDLIFE SERVICE (GEOGRAPHIC INFORMATION SYSTEMS AND SPATIAL DATA).
4. BLOCK 48.20, LOTS 184 AND 189 ARE OWNED BY ROBERT J. MIELE AS TRUSTEE FOR THE TRUST CREATED BY THE LAST WILL AND TESTAMENT OF ANGELO J. MIELE. BLOCK 48.20, LOT 189.01 IS OWNED BY THE GREEN VILLAGE FIRE DEPARTMENT.
5. THE EXTENT OF AREAS WHERE SURFACE WATER FLOW DOES NOT EXHIBIT TYPICAL BED AND BANK MORPHOLOGY IS BASED ON FIELD OBSERVATIONS MADE THROUGHOUT THE PERIOD OF INVESTIGATION ACTIVITIES. THE EXTENT OF THE AREA SHOWN IS APPROXIMATE.
6. ONLY SOIL ANALYTICAL RESULTS GREATER THAN NEW JERSEY NON–RESIDENTIAL SOIL REMEDIATION STANDARDS ARE POSTED.

0 200' 400'
GRAPHIC SCALE

SOURCES:

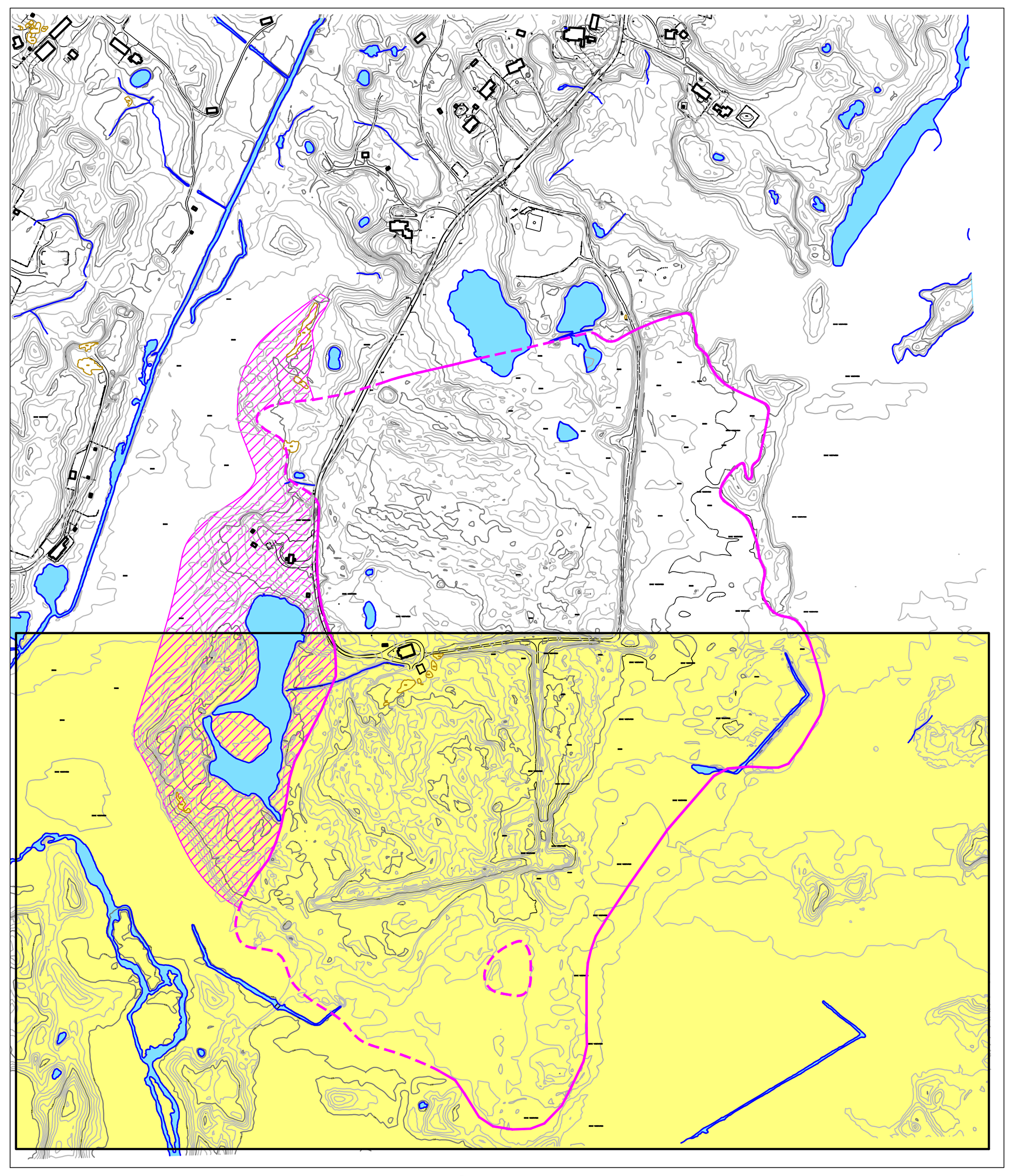
1. BASEMAP FROM JAMES M. STEWART INC., LAND SURVEYORS, PHILADELPHIA, PA., (ELECTRONIC FILE: 292406.DWG DATED: 6/30/06)
2. TAX PARCEL DATA FOR CHATHAM TOWNSHIP WAS PROVIDED BY CIVIL SOLUTIONS.

ROLLING KNOLLS LANDFILL SUPERFUND SITE
CHATHAM, NEW JERSEY
DATA GAPS SAMPLING AND ANALYSIS PLAN

PROPOSED SAMPLE LOCATIONS - NORTH

ARCADIS

FIGURE
3a



SS-17	
Depth(Feet)	(0 – 1)
Date	11/2/2007
SVOCs	
Benzo(a)pyrene	1.2
Metals	
Lead	901 DJ

SS-16	
Depth(Feet)	(0 – 1)
Date	11/1/2007
SVOCs	
Benzo(a)pyrene	1.1 EJ

SS-23	
Depth(Feet)	(0 – 1)
Date	11/2/2007
SVOCs	
Benzo(a)pyrene	0.75

SS-22	
Depth(Feet)	(0 – 1)
Date	6/21/2007
SVOCs	
Benzo(a)anthracene	2.3 [3.3]
Benzo(a)pyrene	2.3 J [3.1]
Benzo(b)fluoranthene	3.3 J [4.5]

SS-19	
Depth(Feet)	(0 – 0.8)
Date	11/2/2007
SVOCs	
Benzo(a)anthracene	2.9
Benzo(a)pyrene	2.9
Benzo(b)fluoranthene	4.4
PCBs (Aroclors)	
Aroclor–1254	2.8 D
Total PCBs (Aroclors)	2.8
PCBs (Congeners)	
Total PCBs (Congeners)	6.41 J
Metals	
Lead	1,090 DJ

SS-24	
Depth(Feet)	(0 – 1)
Date	11/5/2007
SVOCs	
Benzo(a)pyrene	0.65 J
PCBs (Aroclors)	
Aroclor–1248	2.6 D
Aroclor–1260	2.1 D
Total PCBs (Aroclors)	4.7
PCBs (Congeners)	
Total PCBs (Congeners)	6.89 J
Metals	
Lead	1,080 DJ

SS-25	
Depth(Feet)	(0 – 0.85)
Date	11/5/2007
SVOCs	
Benzo(a)pyrene	0.21

SS-95		
Depth(Feet)	(0 – 1)	(6 – 7)
Date	9/10/2009	9/10/2009
PCBs (Aroclors)		
Aroclor–1254	1.7 J	2.1
Total PCBs (Aroclors)	2.46 J	3.73 J
Metals		
Lead	1,550	1,110

SS-18	
Depth(Feet)	(0 – 1)
Date	11/1/2007
SVOCs	
Benzo(a)pyrene	0.77 J

SS-21	
Depth(Feet)	(0 – 1)
Date	6/21/2007
SVOCs	
Benzo(a)anthracene	4.3
Benzo(a)pyrene	4.3 J
Benzo(b)fluoranthene	6.2 J
Indeno(1,2,3–cd)pyrene	2.6 J

SS-79	
Depth(Feet)	(0 – 1)
Date	9/3/2009
PCBs (Aroclors)	
Aroclor–1254	2.7 J
Total PCBs (Aroclors)	4 J
Metals	
Lead	1,900

SS-88		
Depth(Feet)	(0 – 1)	(7 – 8)
Date	9/9/2009	9/9/2009
SVOCs		
Benzo(a)pyrene	0.51 J [0.72 J]	0.88 J
Dibenz(a,h)anthracene	0.21 EJ [0.54 EJ]	0.23 EJ
PCBs (Aroclors)		
Aroclor–1248	1.1 J [0.42 JN]	0.26 U
Aroclor–1254	4.8 J [2.4]	1.6
Total PCBs (Aroclors)	7.29 J [3.39 J]	2.01
Metals		
Arsenic	17.7 [19.8]	17.1
Lead	1,630 [2,370]	1,440

SS-87		
Depth(Feet)	(0 – 1)	(6 – 7)
Date	9/10/2009	9/10/2009
SVOCs		
Benzo(a)pyrene	0.28	0.36
PCBs (Aroclors)		
Aroclor–1254	7.3 J	0.52 J
Aroclor–1260	1.4 J	0.23 J
Aroclor–1268	0.92 U	2.3 J
Total PCBs (Aroclors)	8.7 J	3.26 J
Metals		
Arsenic	22.6	28.2
Lead	1,640	886

SS-20	
Depth(Feet)	(0 – 1)
Date	11/2/2007
SVOCs	
Benzo(a)anthracene	2.7
Benzo(a)pyrene	2.4
Benzo(b)fluoranthene	3.4

SS-80		
Depth(Feet)	(0 – 1)	(9 – 10)
Date	9/2/2009	9/2/2009
SVOCs		
Benzo(a)anthracene	11 D	5.1 D
Benzo(a)pyrene	11 D	5.8 D
Benzo(b)fluoranthene	13 DJ	6 D
Dibenz(a,h)anthracene	1.1 J	0.48 J
Indeno(1,2,3–cd)pyrene	2.5 J	1.5 J
PCBs (Aroclors)		
Aroclor–1254	0.32	1.5
Total PCBs (Aroclors)	0.407	3.18
Metals		
Lead	2,490	1,010

SS-81	
Depth(Feet)	(0 – 1)
Date	9/3/2009
PCBs (Aroclors)	
Aroclor–1242	0.6 U [3.1]
Aroclor–1248	1.7 J [0.6 U]
Aroclor–1254	5 [3.8]
Aroclor–1260	1.1 [0.87]
Total PCBs (Aroclors)	7.8 J [7.77]
Metals	
Lead	2,290 [3,190]

SS-94		
Depth(Feet)	(0 – 1)	(9 – 10)
Date	9/9/2009	9/9/2009
SVOCs		
Benzo(a)pyrene	0.077 EJ	0.22 EJ
PCBs (Aroclors)		
Aroclor–1248	1.3 J	0.16 J
Aroclor–1254	2.9 J	0.38
Total PCBs (Aroclors)	5.03 J	0.67 J
Metals		
Arsenic	16.9	22.7
Lead	1,400	1,040

SS-90		
Depth(Feet)	(0 – 1)	(6 – 7)
Date	9/8/2009	9/8/2009
SVOCs		
Benzo(a)pyrene	0.082 J	0.49
PCBs (Aroclors)		
Aroclor–1242	2.4 U	1.3
Aroclor–1248	17 J	0.6 U
Aroclor–1254	12 J	2.3
Aroclor–1262	2.4 U	3.9
Total PCBs (Aroclors)	29 J	7.5
Metals		
Lead	1,540	1,620 J

SS-82	
Depth(Feet)	(0 – 1)
Date	9/3/2009
PCBs (Aroclors)	
Aroclor–1254	2.3
Total PCBs (Aroclors)	3.1 J
Metals	
Arsenic	22.4 J
Lead	4,010

SS-84	
Depth(Feet)	(0 – 1)
Date	9/2/2009
SVOCs	
Benzo(a)pyrene	0.47 J
PCBs (Aroclors)	
Aroclor–1254	9.4 D
Aroclor–1260	1.2
Total PCBs (Aroclors)	10.6
PCBs (Congeners)	
Total PCBs (Congeners)	125 J
Metals	
Lead	4,510

POI-6	
Depth(Feet)	(0 – 1)
Date	8/25/2009
SVOCs	
Benzo(a)pyrene	0.28 J
Metals	
Lead	2,570 J

SS-85	
Depth(Feet)	(0 – 1)
Date	9/2/2009
PCBs (Aroclors)	
Aroclor–1254	2.2
Total PCBs (Aroclors)	3.74
Metals	
Arsenic	22.8 J
Lead	2,360

POI-18	
Depth(Feet)	(5 – 6)
Date	1/14/2010
PCBs (Aroclors)	
Aroclor–1248	1.1 DJ
Aroclor–1254	2.5 D
Total PCBs (Aroclors)	4.07 J
Metals	
Arsenic	21.2 J
Lead	1,540

SS-91	
Depth(Feet)	(0 – 1)
Date	9/17/2009
SVOCs	
Benzo(a)pyrene	0.59
PCBs (Aroclors)	
Aroclor–1254	3.1
Total PCBs (Aroclors)	4.58 J

POI-17	
Depth(Feet)	(5 – 6)
Date	1/13/2010
PCBs (Aroclors)	
Aroclor–1254	2.1 D [3.1 D]
Aroclor–1260	3.2 D [0.86 J]
Total PCBs (Aroclors)	5.67 [5.15 J]
Metals	
Arsenic	41.9 J [57.7 J]
Lead	1,900 [1,940]

SS-98	
Depth(Feet)	(0 – 1)
Date	9/18/2009
PCBs (Aroclors)	
Aroclor–1248	2.4 J
Aroclor–1254	4.6
Total PCBs (Aroclors)	7.51 J
Metals	
Arsenic	25.7
Lead	2,710

SS-97		
Depth(Feet)	(0 – 1)	(6 – 7)
Date	9/4/2009	9/4/2009
SVOCs		
Benzo(a)pyrene	0.31 D	0.042 D
PCBs (Aroclors)		
Aroclor–1242	5.7	20 J
Aroclor–1254	10	4.8
Total PCBs (Aroclors)	15.7	24.8 J
PCBs (Congeners)		
Total PCBs (Congeners)	50.2 J	NA
Metals		
Arsenic	8.4 J	28.4 J
Lead	1,430	648

SS-96		
Depth(Feet)	(0 – 1)	(9 – 10)
Date	9/9/2009	9/9/2009
PCBs (Aroclors)		
Aroclor–1254	1	1.8 J
Aroclor–1260	1	1.4 J
Total PCBs (Aroclors)	2	3.61 J
Metals		
Lead	2,700	1,230

SS-100	
Depth(Feet)	(0 – 1)
Date	9/10/2009
PCBs (Aroclors)	
Aroclor–1254	2.6
Total PCBs (Aroclors)	4.06 J
Metals	
Lead	2,650

SS-104	
Depth(Feet)	(0 – 1)
Date	9/2/2009
PCBs (Aroclors)	
Aroclor–1248	3.3 D
Aroclor–1254	1.9 D
Total PCBs (Aroclors)	5.57 J
PCBs (Congeners)	
Total PCBs (Congeners)	5.83 J
Metals	
Arsenic	22 J

SS-101		
Depth(Feet)	(0 – 1)	(4 – 5)
Date	9/9/2009	9/9/2009
SVOCs		
Benzo(a)pyrene	0.21 EJ	0.16 J
PCBs (Aroclors)		
Aroclor–1242	1.4	0.63 U
Aroclor–1248	0.61 U	1.9 J
Aroclor–1254	4.4	3.4 J
Aroclor–1260	1.5	2.7 J
Total PCBs (Aroclors)	7.3	8 J
PCBs (Congeners)		
Total PCBs (Congeners)	10.6 J	NA
Metals		
Arsenic	19.5	13
Lead	1,380	3,010

POI-3		
Depth(Feet)	(0 – 1)	(0.5 – 1)
Date	8/25/2009	8/25/2009
VOCs		
Carbon Tetrachloride	NA	4.4
Chloroform	NA	4.5 D
SVOCs		
Benzo(a)pyrene	0.22 J	NA
Metals		
Arsenic	29.3 J	NA
Lead	1,720 J	NA
Manganese	13,600 J	NA
Mercury	85.1	NA

SS-103		
Depth(Feet)	(0 – 1)	(4 – 5)
Date	9/2/2009	9/2/2009
PCBs (Aroclors)		
Aroclor–1248	1.9 DJ	2.3 D
Aroclor–1254	3.1 D	4.1 D
Total PCBs (Aroclors)	5.55 J	7.01
Metals		
Arsenic	20.4 J	15 J
Cadmium	38.1 J	22,500 J
Lead	13,800	951

SS-102		
Depth(Feet)	(0 – 1)	(9 – 10)
Date	9/10/2009	9/10/2009
PCBs (Aroclors)		
Aroclor–1254	2.5	2.1
Total PCBs (Aroclors)	4.22 J	3.75
Metals		
Lead	1,870	4,700

SS-115	
Depth(Feet)	(0 – 1)
Date	9/14/2009
SVOCs	
Benzo(a)pyrene	1.5
Dibenz(a,h)anthracene	0.29 EJ
Metals	
Arsenic	33
Lead	6,170

SS-105	
Depth(Feet)	(0 – 1)
Date	8/26/2009
PCBs (Aroclors)	
Aroclor–1248	4.6 D
Aroclor–1254	4.4 D
Total PCBs (Aroclors)	9.31
PCBs (Congeners)	
Total PCBs (Congeners)	22.7 J
Metals	
Lead	1,070 J

SS-114	
Depth(Feet)	(0 – 1)
Date	9/14/2009
PCBs (Aroclors)	
Total PCBs (Aroclors)	1.17
Metals	
Lead	2,540

SS-110	
Depth(Feet)	(0 – 1)
Date	9/1/2009
SVOCs	
Benzo(a)pyrene	0.83
PCBs (Aroclors)	
Total PCBs (Aroclors)	1.28 J

SS-109	
Depth(Feet)	(0.5 – 1)
Date	8/31/2009
VOCs	
Chloroform	1,900 DJ

SS-107		
Depth(Feet)	(0 – 1)	(5 – 6)
Date	9/8/2009	9/8/2009
SVOCs		
Benzo(a)anthracene	4 D	2.4
Benzo(a)pyrene	3.6 D	2.7
Benzo(b)fluoranthene	4.2 D	3.1 D
Dibenz(a,h)anthracene	0.69 EJ	0.16 J
Metals		
Lead	792	1,070

POI-11	
Depth(Feet)	(0 – 1)
Date	9/1/2009
SVOCs	
Benzo(a)pyrene	0.23 J

SS-108		
Depth(Feet)	(0 – 1)	(4 – 5)
Date	9/8/2009	9/8/2009
SVOCs		
Benzo(a)anthracene	2.7	2.8
Benzo(a)pyrene	3.1	2.9
Benzo(b)fluoranthene	4.5 DJ	3.4 DJ
Dibenz(a,h)anthracene	0.27 J	0.24 J
PCBs (Aroclors)		
Aroclor–1254	0.29	2.5 DJ
Aroclor–1260	0.12	4.8 D
Total PCBs (Aroclors)	0.481	7.81 J
Metals		
Arsenic	9.8 J	28.3 J
Lead	6,270	3,340

SS-122	
Depth(Feet)	(0 – 1)
Date	9/3/2009
PCBs (Aroclors)	
Total PCBs (Aroclors)	1.28
Metals	
Lead	1,270

SS-120	
Depth(Feet)	(0 – 1)
Date	9/3/2009
PCBs (Aroclors)	
Aroclor–1254	1.8
Aroclor–1260	1.6
Total PCBs (Aroclors)	3.4
Metals	
Arsenic	25.3 J
Lead	1,310

POI-2	
Depth(Feet)	(0 – 1)
Date	9/3/2009
PCBs (Aroclors)	
Total PCBs (Aroclors)	2.18
Metals	
Lead	1,490

SS-117	
Depth(Feet)	(0 – 1)
Date	9/17/2009
PCBs (Aroclors)	
Aroclor–1254	1.8 J
Total PCBs (Aroclors)	2.66 J
Metals	
Arsenic	28.5
Lead	1,420 J

SS-121	
Depth(Feet)	(0 – 1)
Date	9/3/2009
PCBs (Aroclors)	
Aroclor–1254	1.7 J
Aroclor–1260	6.9 J
Total PCBs (Aroclors)	8.6 J
PCBs (Congeners)	
Total PCBs (Congeners)	12.3 J
Metals	
Arsenic	30.2 J
Lead	1,340

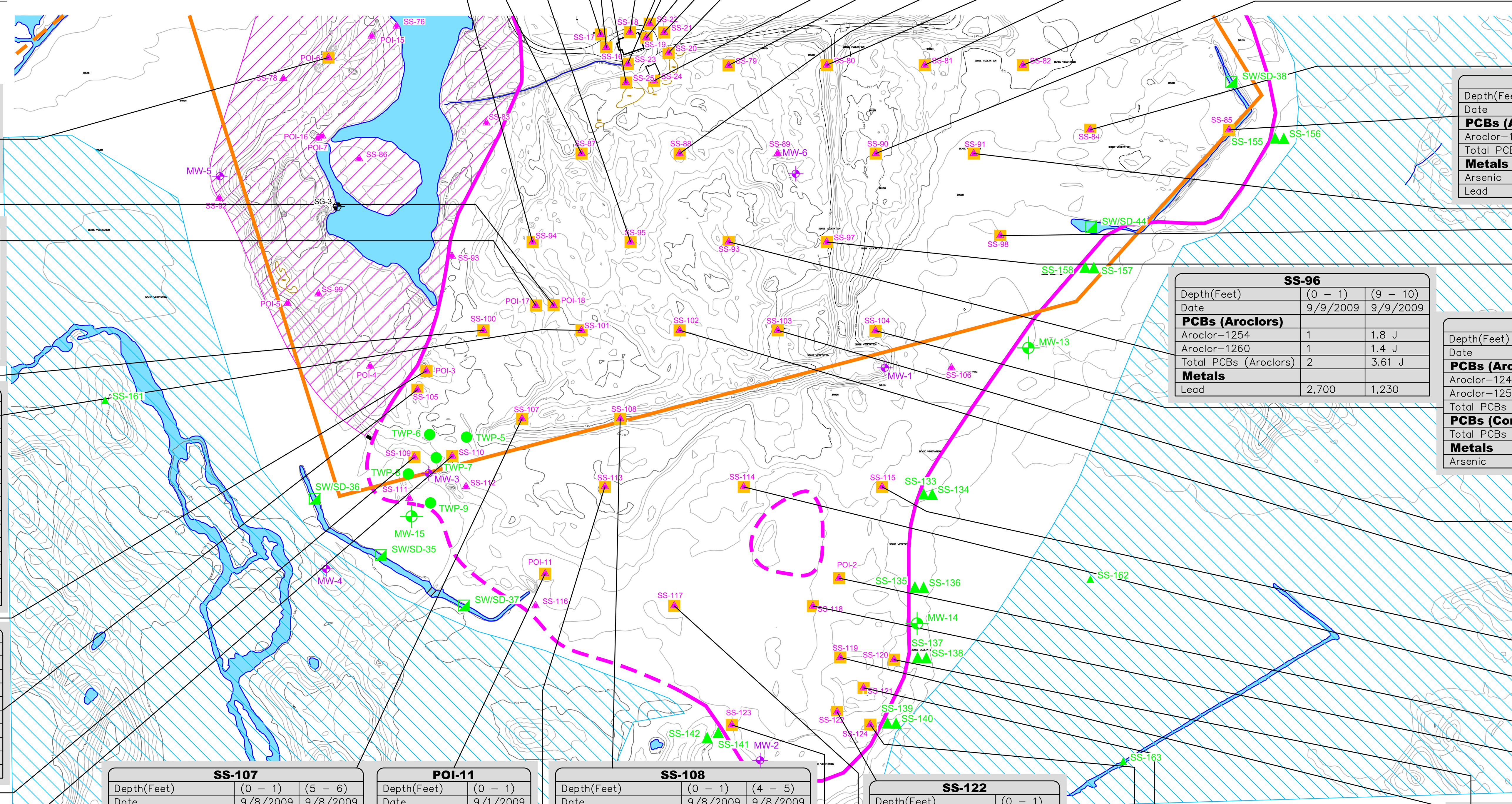
SS-113	
Depth(Feet)	(0 – 1)
Date	9/16/2009
PCBs (Aroclors)	
Aroclor–1254	1.4
Total PCBs (Aroclors)	2.29 J
PCBs (Congeners)	
Total PCBs (Congeners)	3.55
Metals	
Antimony	881 J
Arsenic	33.9
Lead	2,280

SS-119	
Depth(Feet)	(0 – 1)
Date	9/3/2009
SVOCs	
Benzo(a)pyrene	1.5
Benzo(b)fluoranthene	3.2
Dibenz(a,h)anthracene	0.33 EJ
PCBs (Aroclors)	
Aroclor–1254	1.3
Total PCBs (Aroclors)	2.3
Pesticides	
Heptachlor	1.1 D
Metals	
Lead	1,070

SS-118	
Depth(Feet)	(0 – 1)
Date	9/15/2009
SVOCs	
Benzo(a)pyrene	0.4 D
PCBs (Aroclors)	
Aroclor–1242	11 J
Aroclor–1254	7.7 J
Aroclor–1260	4.3 J
Total PCBs (Aroclors)	23 J
Metals	
Lead	2,560

SS-123	
Depth(Feet)	(0 – 1)
Date	9/15/2009
PCBs (Aroclors)	
Aroclor–1254	1.3
Aroclor–1260	1.2
Total PCBs (Aroclors)	3.15
Metals	
Lead	1,370

SS-124	
Depth(Feet)	(0 – 1)
Date	9/15/2009
PCBs (Aroclors)	
Total PCBs (Aroclors)	1.48 J



Nonresidential Soil Remediation Standards

Constituent	Value
VOCs	
Carbon Tetrachloride	2
Chloroform	2
SVOCs	
Acetophenone	5
Benzo(a)anthracene	2
Benzo(a)pyrene	0.2
Benzo(b)fluoranthene	2
Benzo(k)fluoranthene	23
Dibenz(a,h)anthracene	0.2
Indeno(1,2,3–cd)pyrene	2
PCBs	
Aroclor–1242	1
Aroclor–1248	1
Aroclor–1254	1
Aroclor–1260	1
Aroclor–1262	1
Aroclor–1268	1
Total PCBs (Aroclors)	1
PCBs (Congeners)	
Total PCBs (Congeners)	1
Pesticides	
Aldrin	0.2
alpha–Chlordane	1
Dieldrin	0.2
gamma–Chlordane	1
Heptachlor	0.7
Heptachlor epoxide	0.3
Metals	
Antimony	450
Arsenic	19
Cadmium	78
Copper	45,000
Lead	800
Manganese	5,900
Mercury	65
Vanadium	1,100

LEGEND:

- OPEN WATER
- EDGE OF LANDFILLED WASTES OBSERVED DURING TEST PIT ACTIVITIES (DASHED WHERE APPROXIMATE)
- GREAT SWAMP NATIONAL WILDLIFE REFUGE PROPERTY BOUNDARY (DASHED WHERE APPROXIMATE)
- WASTE AND DEBRIS OBSERVED ON GROUND SURFACE BUT NOT OBSERVED OR ANTICIPATED TO BE BELOW GROUND SURFACE
- AREAS WHERE SURFACE WATER FLOW DOES NOT EXHIBIT TYPICAL BED AND BANK MORPHOLOGY
- SOIL SAMPLING LOCATION
- SOIL SAMPLING LOCATION WITH DETECTED CONCENTRATIONS GREATER THAN NJDEP NONRESIDENTIAL SOIL REMEDIATION STANDARDS
- PROPOSED MONITORING WELL
- EXISTING MONITORING WELL
- PROPOSED TEMPORARY WELL POINT
- PROPOSED SOIL SAMPLE
- PROPOSED SURFACE WATER AND SEDIMENT SAMPLE
- EXISTING STREAM GAUGE

DATA NOTES:

UNITS = MILLIGRAMS PER KILOGRAM

[] = DUPLICATE SAMPLE

PCBS = POLYCHLORINATED BIPHENYLS

SVOCS = SEMIVOLATILE ORGANIC COMPOUNDS

VOCS = VOLATILE ORGANIC COMPOUNDS

NA = NOT ANALYZED

D = CONCENTRATIONS IDENTIFIED FROM ANALYSIS OF THE SAMPLE AT A SECONDARY DILUTION.

E = THE COMPOUND WAS QUANTITATED ABOVE THE CALIBRATION RANGE.

J = THE COMPOUND WAS POSITIVELY IDENTIFIED; HOWEVER, THE ASSOCIATED NUMERICAL VALUE IS AN ESTIMATED CONCENTRATION ONLY.

JN = THE ANALYSIS INDICATES THE PRESENCE OF A COMPOUND FOR WHICH THERE IS PRESUMPTIVE EVIDENCE TO MAKE A TENTATIVE IDENTIFICATION. THE ASSOCIATED NUMERICAL VALUE IS AN ESTIMATED CONCENTRATION ONLY.

U = THE COMPOUND WAS ANALYZED FOR BUT NOT DETECTED. THE ASSOCIATED VALUE IS THE COMPOUND QUANTITATION LIMIT.

RX = THE SAMPLE RESULTS ARE REJECTD DUE TO MATRIX INTERFERENCE.

NOTES:

1. ANALYTICAL RESULTS GIVEN IN MILLIGRAMS PER KILOGRAM FOR SOIL SAMPLES WITH DETECTED CONCENTRATIONS GREATER NEW JERSEY NONRESIDENTIAL SOIL REMEDIATION STANDARDS (DATED OCTOBER 2011).
2. THE EDGE OF LANDFILLED WASTES OBSERVED DURING TEST PIT ACTIVITIES IS DRAWN BASED ON OBSERVATIONS OF MATERIALS EXCAVATED DURING TEST PIT ACTIVITIES CONDUCTED FROM JULY 26, 2007 TO SEPTEMBER 6, 2007 AND MARCH 26, 2008.
3. THE PORTION OF THE GREAT SWAMP NATIONAL WILDLIFE REFUGE (GSNWR) PROPERTY BOUNDARY ON THIS FIGURE WITHIN CHATHAM TOWNSHIP, NJ WAS OBTAINED FROM CHATHAM TOWNSHIP TAX PARCEL DATA PROVIDED BY CIVIL SOLUTIONS. THE PORTION OF THE GSNWR PROPERTY BOUNDARY ON THIS FIGURE OUTSIDE OF CHATHAM TOWNSHIP IS APPROXIMATE AND WAS OBTAINED FROM THE UNITED STATES FISH AND WILDLIFE SERVICE (GEOGRAPHIC INFORMATION SYSTEMS AND SPATIAL DATA).
4. BLOCK 48.20, LOTS 184 AND 189 ARE OWNED BY ROBERT J. MIELE AS TRUSTEE FOR THE TRUST CREATED BY THE LAST WILL AND TESTAMENT OF ANGELO J. MIELE. BLOCK 48.20, LOT 189.01 IS OWNED BY THE GREEN VILLAGE FIRE DEPARTMENT.
5. THE EXTENT OF AREAS WHERE SURFACE WATER FLOW DOES NOT EXHIBIT TYPICAL BED AND BANK MORPHOLOGY IS BASED ON FIELD OBSERVATIONS MADE THROUGHOUT THE PERIOD OF INVESTIGATION ACTIVITIES. THE EXTENT OF THE AREA SHOWN IS APPROXIMATE.
6. ONLY SOIL ANALYTICAL RESULTS GREATER THAN NEW JERSEY NON–RESIDENTIAL SOIL REMEDIATION STANDARDS ARE POSTED.

SOURCES:

1. BASEMAP FROM JAMES M. STEWART INC., LAND SURVEYORS, PHILADELPHIA, PA., (ELECTRONIC FILE: 292406.DWG DATED: 6/30/06)
2. TAX PARCEL DATA FOR CHATHAM TOWNSHIP WAS PROVIDED BY CIVIL SOLUTIONS.

0 200' 400'
GRAPHIC SCALE

ROLLING KNOLLS LANDFILL SUPERFUND SITE
CHATHAM, NEW JERSEY

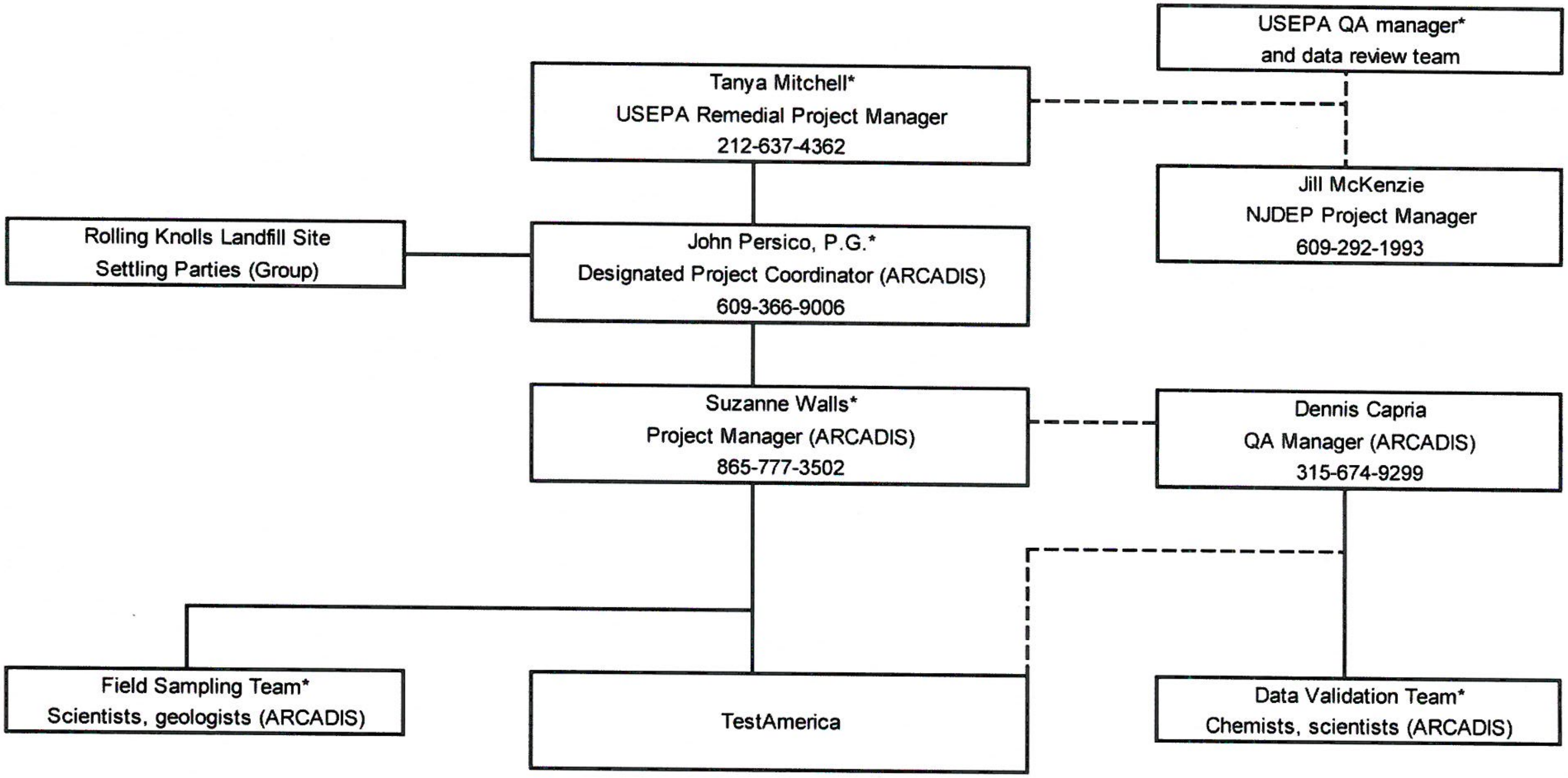
DATA GAPS SAMPLING AND ANALYSIS PLAN

PROPOSED SAMPLE LOCATIONS - SOUTH

ARCADIS

FIGURE
3b

CITY:CRANBURY-NJ DIV/GROUP:ENVCAD DB:JMEYER LD:FATTO PIC:(Opt) PM:A.GUTHERZ TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\CRANBURY\ACT\B0033203\0003\00110\B0033203N02.dwg LAYOUT: 4 SAVED: 10/28/2014 11:22 AM ACADVER: 18.1S (LMS TECH) PAGESETUP: — PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 10/29/2014 10:30 AM BY: MEYER, JULIE
XREFS: IMAGES: PROJECTNAME: —



* - QAPP recipient

ROLLING KNOLLS LANDFILL SUPERFUND SITE
CHATHAM, NEW JERSEY
DATA GAPS SAMPLING AND ANALYSIS PLAN

PROJECT ORGANIZATIONAL CHART

ARCADIS

FIGURE
4